The FOUNDRY

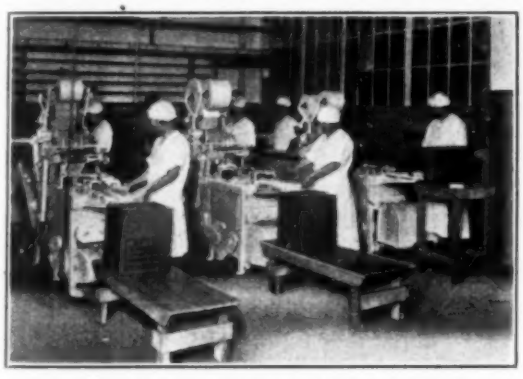
Volume 57
Number 2

Published
Semimonthly

CLEVELAND, OHIO, JANUARY 15, 1929

Castings Aid in Changing Marketing Methods

IT MAY seem like a long step from the problem of marketing food in a sanitary manner to increasing business for the foundry industry, but the development of one has resulted in the growth of the other. Just a few years ago, the buyer of food products usually purchased such supplies as flour, sugar, rice, prunes, butter and perhaps a hundred other items, in bulk. The package article was scorned by the vast majority, in all probability



Courtesy Automat Molding & Folding Co.
Wrapping and Cartoning Machines Are Constructed Mainly of Castings

because the hand methods used to prepare the merchandise in package form usually added considerably to the cost. However, numerous machines have been developed and now are in use which perform these operations at a greatly reduced cost. The methods employed possess the added attraction that it is not necessary for human hands to touch the food in preparation. These machines include such types as wrapping machines, cartoning machines, cutting and printing machines for preparing butter prints, ice cream in bricks, etc., filling and capping machines for filling ice cream cups, and numerous others. Of course, the foundry industry has benefited through this development since the majority of machines are designed chiefly with castings. Rigidity resistance to corrosion and resistance to wear are some of the qualities possessed by castings which are essential in the machines.

Find Where Castings Can Be Sold.

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PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.
BRANCH OFFICES

CHICAGO ..... 1147 Peoples Gas Bldg.
CINCINNATI ..... 209 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
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PARIS, FRANCE ..... No. 9 Rue de Londres
BERLIN, GERMANY ..... Wilhelmstrasse 114, Berlin S. W. 48

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

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Operates Foundry On Top of the ndes

By
Thomas H. Stickley

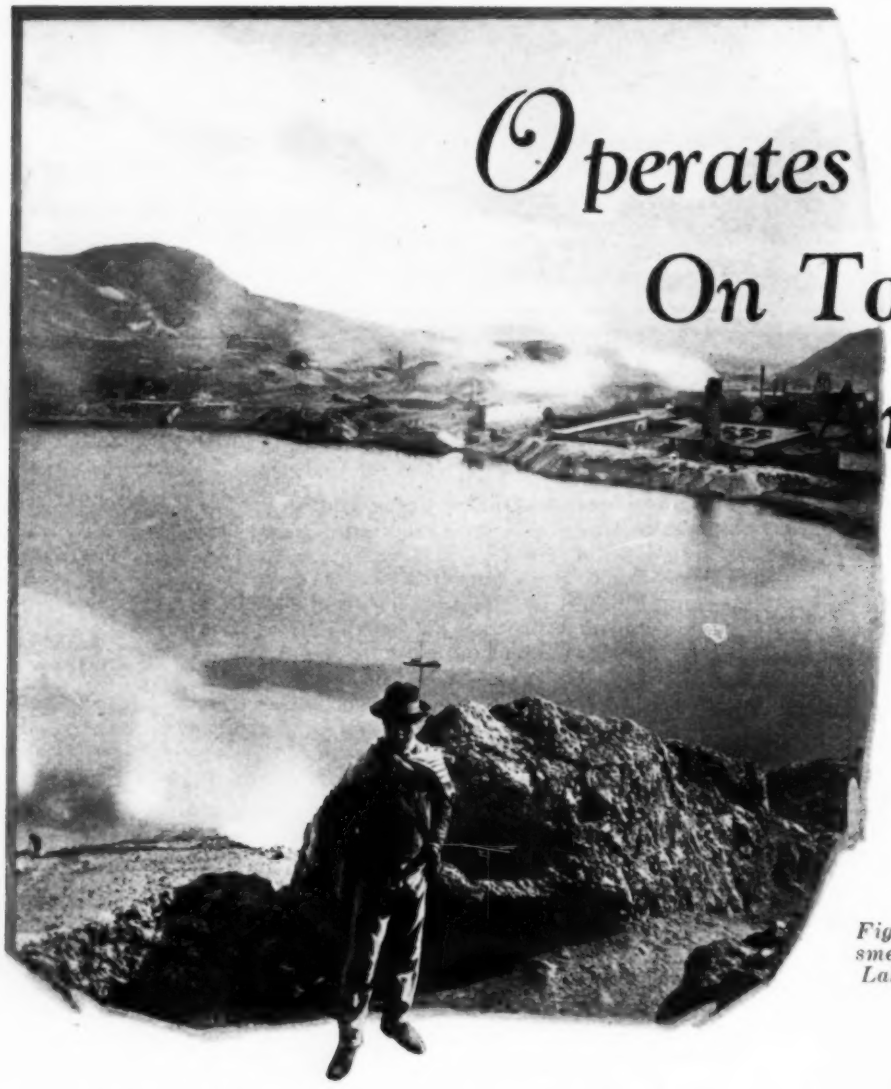


Fig. 1—Native Peruvian smelters in the distance on Lake Patarcocha de Lavar

DESCRIPTION which appeared in a recent issue of a technical publication of the trouble encountered and the methods employed over a period of two years to recover the flooded workings of a copper mine in Peru, called to mind a period of five years, twenty years ago when I served as foundry foreman for the same company, now known as the Cerro de Pasco Copper Corp., at its plant in La Fundicion near the ancient city of Cerro de Pasco high up in the Andes mountains of Peru.

The mines date back to an exceedingly remote period and were worked originally by the Incas for the silver which later lured Pizzaro and his conquistadors over the mountain ranges where they sacked and ravaged the country to an extent that has left its impress on the terrified inhabitants down to the present.

In the Inca days and later during the days of Spanish possession, the richest of the silver ore was treated by methods and in a manner peculiar to the period. Eventually the high grade ore was exhausted and the existing ore under the conditions and methods available could not be reduced and marketed at a price that would yield a profit. During this period of depression the Cerro de Pasco Copper Corp., known at the time as the Cerro de Pasco Mining Co., bought the property and instituted a modern program of development that involved, it is claimed, the expenditure of $20,000,000 before producing a pound of copper. The mine contained a great quantity of high grade sulphate copper ore running about 10 per cent copper, besides silver and a little gold.

Construction included 125 miles of railroad, powerhouse, smelter, coke ovens, coal washer, machine shop, foundry, boiler shop, carpenter shop and hotel for American employes. Property included 730 mineral claims on 5900 acres also 70,000 acres of hacienda. The smelter, coke ovens and coal washer were located at Tinahuarcho, 9 miles from the coal areas covering 1800 acres. Later the company took over the mineral claims of the Morochoca Mining Co., covering 6000 acres. From 1907 to 1912 the monthly production of copper was in the vicinity of 6,000,000 pounds, with 200 ounces of silver and ¾-ounce of gold to the ton. The product was shipped to a New Jersey refinery. A new smelter at Aroya was completed in 1922 with a daily capacity of 2500

tons. The plant has been enlarged to a great extent in recent years and I understand bears little resemblance to what it was when I arrived there in 1907.

At the annual meeting held in New York in May, 1928, officials of the corporation stated that 20,000,000 tons of oxidized silver ore running from 8 to 10 ounces to the ton were on hand on its property. Experiments were under way with methods of handling this ore. During the past two years $500,000 had been spent on this problem. At this meeting also it was announced that the corporation had a daily lead output of 50 tons and was preparing to market zinc. Expenditure of approximately $10,000,000 was in contemplation for further development in the immediate future.

Before going to Peru as foundry foreman for the Cerro de Pasco Mining Co., I had considerable foundry experience in iron and brass, mostly in the Chicago district. After leaving school at the age of 15 in the late eighties, I was taken on as an apprentice in the foundry of the Waterous Engine Works Co., Brantford, Ont., where I served four years at various branches of the trade including core making, brass molding, iron molding and cupola practice. As a young journeyman molder I went to Chicago and worked there for Frazer & Chalmers under the direction of W. Ferguson. He took a friendly interest in my progress and gave me the opportunity to improve my knowledge on high class work. In 1894, I worked for a short time in a small shop in Bay City, Mich., but returned to Chicago in response to an invitation from Mr. Ferguson when he assumed charge of the Gates Iron Works. I continued with him for several years, first at this shop and later in his own shop known under the title of Ferguson and Lange Foundry Co.

All these foundries catered extensively to the mining industry and employed a highly skilled class of molders. Many of these men later assumed important positions elsewhere, either as owners or managers, superintendents and foremen. Donald J. Campbell and G. W. Cannon of the present immense Campbell, Wyant & Cannon foundries located at Muskegon, Mich., worked with me on the floor at that time. While working for W. Breckinridge at the Otis Elevator Works, 15th and Laflin streets early in 1907, I was tendered and accepted the position of foundry foreman for the Cerro de Pasco Mining Co., at its new foundry up in the Andean mountains of Peru, at an elevation of 14,000 feet above sea level.

The journey from the United States to the southern destination occupied approximately three weeks and presented many interesting features including a shipwreck on the rocks of Lobos island and two nights and a day in an open boat with a consequent loss of all belongings except one suit of clothes. This included, of course an excellent kit of molders tools.

We left New York July 18 and arrived at Colon, July 25. The canal was not built at that time, therefore we crossed the isthmus by train to Panama. From Panama we shipped in a steamer for Callao, pronounced *Ca-ya*, on the West coast, but on the way we stopped at Guayaquil, Ecuador

Fig. 2—Shaft house, powerhouse and dumps of a silver and copper mine

for 24 hours. The second stop was at Paita, Peru, from which we sailed in the evening and expected to arrive at Etan in the morning. About midnight the steamer ran on the rocks of Lobos island and piled up a complete wreck. The passengers escaped in lifeboats and made the main land by morning where they remained until the following day before they were taken off by another boat and conveyed to Callao, minus clothes, tools and all other worldly possessions taken aboard at Panama.

From Callao we proceeded to Lima and after securing a new outfit, we left by train on Aug. 8 for the city of Cerro de Pasco, or rather for La Fundicion, the site of the company's plant, 9 miles south of the city. In a distance of 106 miles the train passed through 60 tunnels and crossed 23 bridges and at one point, a place called Ticlio, reached an elevation of 15,665 feet. This place marks the dividing line on the Andean water shed and is not far from the origin of several rivers that later unite to form the Marano that eventually becomes the Amazon, greatest river on earth.

The highest tunnel in the system is one mile in length and passes under the summit of Mount Meigs, altitude 17,575 feet and named after the famous engineer who built this remarkable road with no grade over 4 per cent. Rarefaction of the air at this altitude where the pressure is only 7½ pounds per square inch, as opposed to approximately 15 pounds at sea level, induces headache.

Rest for a few days effected the necessary adjustment to new conditions and then I had an opportunity of sizing up the foundry which I found equipped in a thoroughly up-to-date manner with a 10-ton traveling crane, a 48-inch cupola made by the Whiting Corp., Harvey, Ill., a blower made by the P. H. & F. M. Roots Co., Connersville, Ind., a good core oven and a brass furnace. Supply of raw materials was not so satisfactory. I found no sand, no blacking, no seacoal. The domestic coke was high in ash and sulphur and later I had to mix it with German coke to utilize it in the cupola. I found about 50 tons of a peculiar brand of British pig iron which probably came across the ocean as ballast in the hold of a windjammer. A small quantity of miscellaneous scrap completed the inventory.

A crew of 30 men had been recruited from the district and assigned to the foundry. None of them could speak a word of English and I was equally proficient in Spanish and Indian, which means that I did not know a word of either language.

All the members of the executive operating staff were skilled copper men, but with no knowledge of iron foundry practice. I had to depend on my initiative and knowledge all the way through. At my solicitation the superintendent ordered pig iron from England and coke from Germany. Freight rates dictated the choice in each instance. The pig iron was a well-known brand. It is exported quite extensively and I had been familiar with it during my term of service with the Waterous Engine Works Co., Brantford, Canada. The iron is soft and strong with an approximate analysis as follows: Silicon, 2.85 per cent; sulphur, 0.04 per cent; phosphorus, 0.90 per cent; manganese, 1.00 per cent and total carbon, 3.95 per cent. Both coke and iron had to be shipped around Cape Horn and the freight rates from England and Germany were considerably lower than those charged on similar products from the United States.

On muleback I conducted a scouting trip for a supply of molding and core sand and found satisfactory deposits close by the railroad right of way. Mud from the coal washer was dried and then utilized in the usual manner as coal dust or sea coal.

The cupola, lined to a diameter of 48 inches, was too large and melted too fast for the size of the shop and the number of men employed. A thickness of brick on edge and another on the flat reduced the diameter to 36 inches; quite ample for a heat between 6 and 8 tons poured every other day. Afterward, on account of extensions to the plant, the volume of castings increased through quite an extensive variety. I had castings to make for the mines, railroad, powerhouse, blast furnaces, coke ovens and converters. In a short time the cost of making the castings was reduced to approximately one-sixth of the cost of imported castings.

The mountainous character of the

Mine Is Flooded

EARLY in December 1928, several newspapers carried a dispatch to the effect that the bottom of Morochoca lake had fallen out and flooded the workings of the Yankee Claim, one of the copper mines of the Cerro de Pasco Copper Corp., in Peru. According to later cables from the mine the cavein occurred above the level of the lake and is thought to have been caused by a rush of mud from some surface depression and that the inflow of water had no connection with the lake. The mine is 1000 feet deep and bulkheads have prevented the water from rising above the 750-foot level.

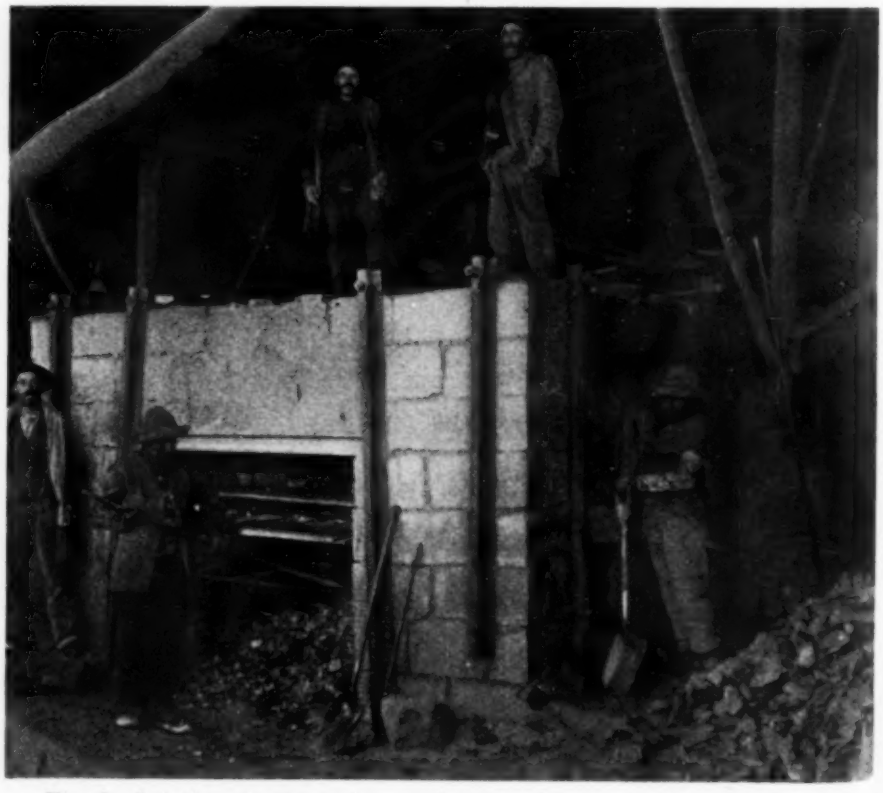


Fig. 3—Interior of a Peruvian smelter showing construction of furnace

country was a decided asset in the construction and operation of the foundry. One railroad track was located on the same level as the floor of the foundry and the sand sheds where the sand was protected from the elements. A second railroad track was laid at the level of the charging floor. Coke, pig iron and scrap were unloaded in the vicinity close to the charging floor. Coke was kept in a covered bin with a capacity of about 50 tons, about three months' supply. Materials were taken to the charging floor day by day with a minimum expenditure of time and labor.

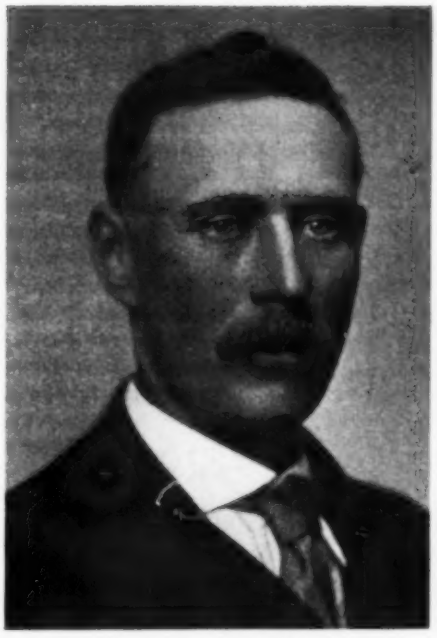
I had to adjust myself to the metric system of weights and measures which is in use in Peru. Weights were on the British system; that is, a ton is equivalent to 2240 pounds while the hundredweight is 110 pounds. With these two units established the charges were made up in the same manner to which I had been accustomed elsewhere.

Before my five-year term expired I could understand and use the language sufficiently to get along in the shop without an interpreter, but I did not develop into a proficient Spanish scholar and could not carry on a protracted or connected conversation. I liked the people. They are exceedingly proud in some respects. Many are descendants of the Incas, but apparently the Spaniards instilled a fear in them from which they never have recovered. They speak the Spanish language, but they also have an Indian dialect of their own. The molders in the plant came from Lamas and Tabalosos and some of them developed into exceedingly skillful molders. In my time I worked for four superintendents in succession. Two resigned, one was killed and the fourth wanted me to stay when my term expired, but I felt that five years on the outposts of civilization was enough. Ties of kindred, home and friendship drew me back to the United States.

Book Review

Das Geschuetz im Mittelalter, by Bernhard Rathgen, cloth, 732 pages, 8¼ x 11¾ inches, published by the Verein deutscher Ingenieure-Verlag, Berlin, Germany.

Early in life General-lieutenant Bernhard Rathgen became acquainted with Hermann Mueller, famous artilleryman, and prominent historian of the German artillery. He became imbued with a thought to follow Mueller's example and delve into history. Naturally, he went to his own profession, artillery, where he was best informed and in 1901 began this work on cannon in the middle ages, which occupied his time until his death in 1927. To



Thomas H. Stickley

obtain the first periods when any type of artillery made its appearance, Rathgen consulted many historical ancient works, and through his book refers to the various sources. In the introduction the author states that the arms industry was developed in Frankfort during 1348 to 1440. Chapter II deals with the powder weapons in Frankfort and chapter III relates the application of powder weapons from 1352 to 1377. Chapter IV describes cannon firing stone shot. Equipment for safe defense of city fortifications in 1391 is described in chapter V, while chapter VI deals with cast iron cannon in 1391. Chapter VII describes the siege of Hattstein in 1393, and chapter VIII covers the great Frankfort cannon of 1394. Other chapters relate to the use of cannon at the siege of Tannenburg, Frankfort burghers' hand rifles, powder and saltpeter making in Frankfort, powder arms manufacture in Naumberg, Trier and other German cities, and the Cologne cannon. Descriptions, construction and other data are presented on such famous old cannon as the Erfurt, Great Gun of Caen, Dresden Bad Magda, Nuremburg, the Great Gun of Goettingen and the Bad Greta. Arms manufacture in Switzerland, Burgundy, Spain and Italy also are described. Ancient devices, such as the catapult, are mentioned in the last chapters in the book.

Evidence has been secured by the department of commerce, bureau of standards, that the blistering of enameled cast iron ware can be reduced by sandblasting the castings a sufficient length of time to remove the surface skin.

A. F. A. Plans Contests for Apprentices

Apprentice contests which have been held in connection with the recent conventions of the American Foundrymen's association will be continued as an annual feature. Complete information regarding regulations are ready for distribution to those plants planning to have apprentices take part.

The contest for 1929 will be held in three divisions: namely, gray iron molding, steel molding, and pattern-making. Three prizes will be given in each division. The first prizes will consist of wrist watches valued at $50; the second prize will be cash awards of $25, and the third prizes will be cash awards of $10. Each apprentice receiving a prize will also be given an engraved certificate.

Local contests to determine the castings and patterns to be submitted in the national contest can be held either by individual plants, local foundrymen's associations, or similar organizations, conducting their contests to conform to the rules and regulations laid down by the American Foundrymen's association apprentice contest committee. Local contests must be held in time to have the entries in the national contest reach the Chicago convention hotel by April 2. Copies of the regulations may be had upon application to the secretary of the American Foundrymen's association, 222 West Adams street, Chicago.

These contests, beginning with the Milwaukee convention in 1924 with only Milwaukee firms participating, have grown in extent till at the 1928 convention 20 plants from 6 foundry centers had apprentice work entered in the national contest and many more had taken part in the local contests.

Firms Are Combined

Niles Tool Works Co., formerly owned by the Niles-Bement-Pond Co., New York, and the Hooven, Owens, Rentschler Co., both of Hamilton, O., have been consolidated under the ownership of the General Machinery Corp. The officers and directors of the new corporation are: G. A. Rentschler, president; Gordon S. Rentschler, assistant to the president; William B. Mayo, vice president; A. A. Byerlein, vice president; Curtis T. Zeigler, vice president; Walter A. Rentschler, secretary and treasurer. The directors are: Edward A. Deeds, Fred B. Rentschler, J. K. Cullen, G. H. Helvey, C. H. Helvey, Leonard S. Horner, and Sandford G. Etherington.

Explains

Manganese Steel Production *in the* Electric Furnace

By J. Trantin Jr.

SINCE much has been written on sand control, it will not be necessary to enter into a further discussion of this phase of foundry practice. However, it may be well to impress the importance of proper gating and heading of castings. It is the author's firm belief that proper and intelligent gating is 50 per cent accountable for the production of good castings. Many foundrymen are inclined to be somewhat old fashioned in their ideas of cutting a gate or runner merely to furnish a passageway for the metal to enter the mold with utter disregard of hydrostatic pressure. This statement may seem somewhat ridiculous, nevertheless, there are many offenders.

It should be borne in mind that careful thought and analysis are prerequisites to correct placing of gates and if this requirement of the essentials of sound practice be fulfilled, much promiscuous gate cutting will be eliminated. As a matter of illustration the following reasoning is submitted. First of all, the job must be analyzed thoroughly. Then the location of sprues, gates and heads must be determined. Finally the shape, cross section, number of gates and number and sizes of heads must be calculated to assure proper flow and distribution of metal.

Castings of intricate design must be shaken out of the molds soon after the metal has set to prevent cracking and in the case of long castings such as frogs, liners, racks, etc., which are supplied with risers, the sand surrounding the sprues and heads must be relieved so as to facilitate shrinkage.

Shows the Effect

IN THE first article of this series on the manufacture of manganese steel which appeared in the Jan. 1 issue, page 15, the author described the principles underlying the melting of the steel. This second article deals with the heat treatment of manganese steel, and the author presents the results of a number of investigations to show the effect of treatment at different temperatures. Micrographs also are included to show the variations in grain structure at these temperatures. The third and concluding article will appear in an early issue.

Manganese steel when cast has a variable structure dependent upon the rate of cooling, which is governed by the section of the casting and the treatment given during the shaking out process. The structure may vary from pure austenite to martensite. In most cases, however, it is found that the resultant structure is austenitic accompanied by a separation of manganiferous carbide around the grain boundaries. In thin section castings, which cool rapidly, the precipitation of the carbides is arrested and consequently the pure austenitic structure is retained.

The heat treating operation is fully as important as the manufacture of the steel itself, for if the casting is submitted to improper thermal treatment, it is certain to fail in service due either to breakage or to inferior wearing qualities. Common practice is to bring the temperature of the castings to 1850 degrees Fahr. and subsequently quench them in water. Results of investigations for determining the proper heat treating temperature and the effect of reheating will be discussed later.

Castings may be treated in either a gas fired, oil fired or electric furnace with the same degree of accuracy, provided careful supervision be exercised. The tendency is toward electricity in localities where the power rate is not excessive, owing to the ease of operation and the uniform rate of heat transfer. So far as sur-

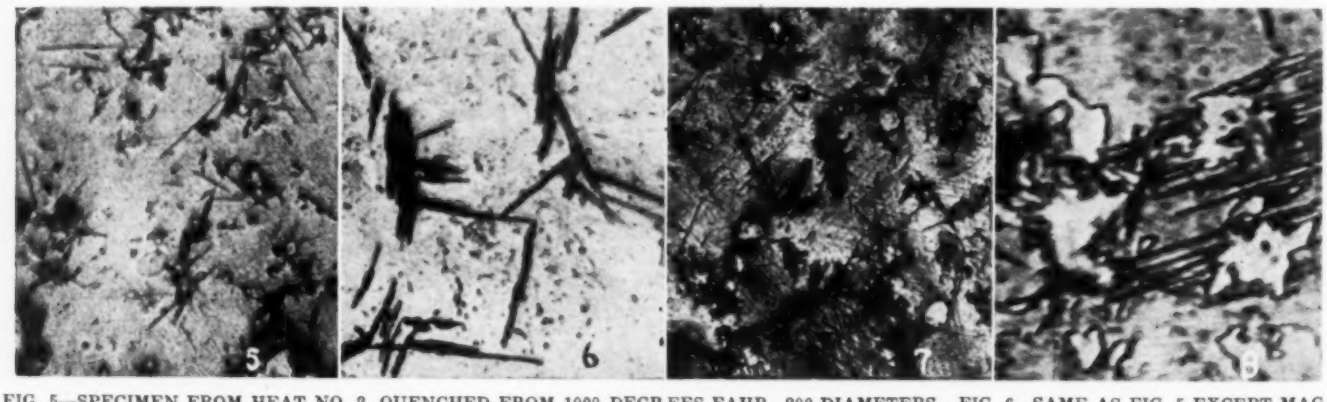
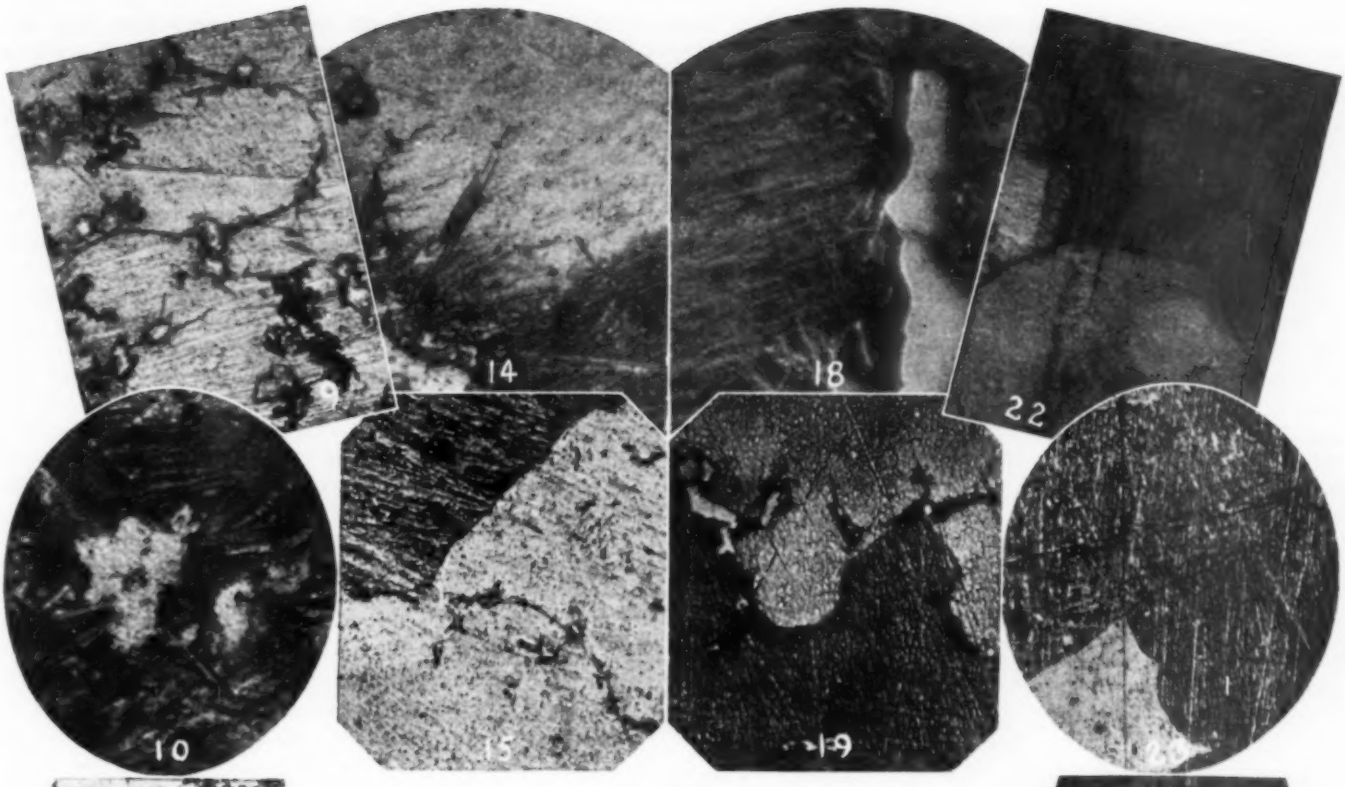


FIG. 5—SPECIMEN FROM HEAT NO. 2, QUENCHED FROM 1000 DEGREES FAHR., 200 DIAMETERS. FIG. 6—SAME AS FIG. 5 EXCEPT MAGNIFIED 1000 DIAMETERS. FIG. 7—HEAT NO. 9, QUENCHED FROM 1200 DEGREES, 200 DIAMETERS. FIG. 8—SAME AS FIG. 7 EXCEPT MAGNIFIED 1000 DIAMETERS



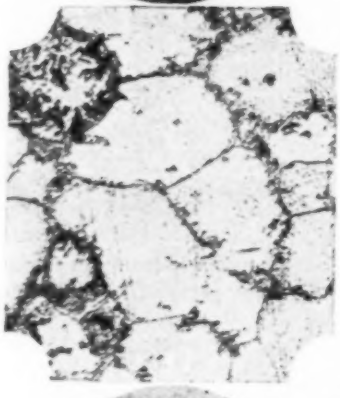
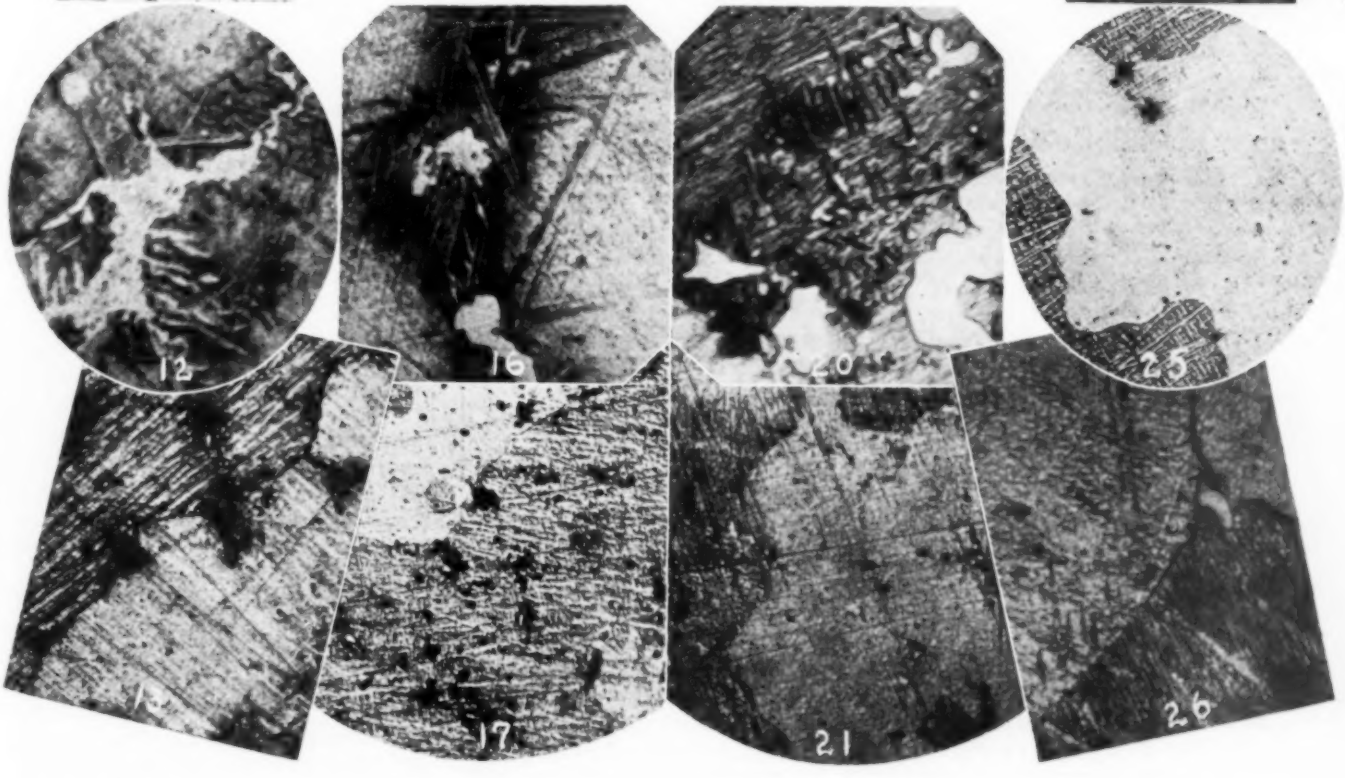


Fig. 9—Heat No. 12, quenched from 1500 degrees, 200 diameters. Fig. 10—Same as Fig. 9 except magnified 1000 diameters. Fig. 11—Heat No. 19, quenched from 1600 degrees, 200 diameters. Fig. 12—Same as Fig. 11 except magnified 1000 diameters. Fig. 13—Heat No. 22 quenched from 1700 degrees, 200 diameters. Fig. 14—Same as Fig. 13 except magnified 1000 diameters. Fig. 15—Heat No. 27, quenched from 1700 degrees, 200 diameters. Fig. 16—Same as Fig. 15 except magnified 1000 diameters. Fig. 17—Heat No. 31, quenched from 1800 degrees, 200 diameters. Fig. 18—Same as Fig. 17 except magnified 1000 diameters. Fig. 19—Heat No. 35, quenched from 1850 degrees, 200 diameters. Fig. 20—Same as Fig. 19 except magnified 100 diameters. Fig. 21—Heat No. 41, quenched from 1900 degrees, 200 diameters. Fig. 22—Same as Fig. 21 except magnified 100 diameters. Fig. 23—Heat No. 45, quenched from 1950 degrees, 200 diameters. Fig. 24—Same as Fig. 23 except magnified 1000 diameters. Fig. 25—Heat No. 49, quenched from 2000 degrees, 200 diameters. Fig. 26—Same as Fig. 25 except magnified 1000 diameters



face decarbonization is concerned, the gas and oil fired furnaces are said to have a slight advantage over the metal grid type of electric furnace, for in the first two a reducing atmosphere may be maintained by admitting an excess of fuel. However, this disadvantage of the electric grid type of furnace may be offset by charging coke with the burden to combine with the excess oxygen.

Discretion must be used in charging the castings due to the great thermal expansion characteristic of manganese steel, which is approximately 5/16-inch per foot. Too much stress cannot be laid upon the proper handling of the castings in the raw state to prevent cracking. Castings of heavy and irregular section must be shaken out as soon as possible and charged immediately into a warm furnace (not exceeding 1200 degrees Fahr.). Thin, uniform-sectioned castings may be charged cold into either a cold furnace and brought up to temperature with the furnace, or into a hot furnace. Small castings such as chain links may be charged into a hot continuous furnace without danger of cracking.

Definite rules cannot be laid down for charging castings for this must be left to the discretion of the operator. Three methods for this procedure are: Charging hot castings into a hot furnace; charging cold castings into a hot furnace, and charging cold or hot castings or both into a cold furnace and bringing them to temperature with the furnace.

After the proper temperature has been attained and the castings have been allowed to soak sufficiently for the heat to penetrate, they should be quenched with as little delay as possible in cold running water; the rate of heating and the time of soaking being dependent upon the section of the castings treated.

Manganese steel castings designed for resisting shock must be heat treated so as to obtain maximum toughness. To accomplish this end the following factors must be taken into consideration: Rate of heat application; time of soaking, and temperature.

The first is dependent upon the intricacy and varying thickness of the casting as a preventative means against cracking; the second upon the maximum thickness of the casting, which insures thorough heating, and the third upon the chemical analysis, particularly the carbon content. The following discussion will be limited to the effect of temperature on the characteristics of manganese steel containing approximately 12 per cent manganese.

That maximum toughness may be imparted to the steel, it must be heat treated so as to render the structure purely austenitic and free from undissolved carbides. The governing factor is the application of the correct amount of heat or temperature for any specific analysis. The temperature generally accepted by manufacturers for heat treating manganese steel, irrespective of carbon content, ranges from 1830 to 1850 degrees Fahr. For steels containing approximately 1 per cent carbon 1850 degrees will suffice to effect solution of the carbides. Further additions of carbon, however, change the equilibrium conditions to such an extent that a greater application of heat is necessary to produce the desired results.

Breakages under impact and poor performance of manganese steel in service in a great number of cases have been attributed to improper heat treatment, frequently underheating. This led to an investigation with a view to ascertaining some means whereby these difficulties may be overcome.

The procedure was to pour a number of cast-to-shape test bars from one heat at approximately the same temperature. As a further means of securing uniformity, the bars were cast in cores and allowed to cool to room temperature before removal. Each core contained two castings placed upright and gated at the bottom from a sprue common to both. The resulting bars were 7/8-inch in diameter and 12 inches long, reduced at the center to a diameter of 0.570 of an inch for a distance of 2¼ inches.

Several bars were quenched at various temperatures ranging from 1000

Table VI

Results of Physical Tests

Spec. No.	Ultimate St. (lb. per sq. in.)	Elongation in 2 in. per cent	Reduction of area, per cent	Quenching temperature deg. Fahr.	Remarks
1	80700	1.21	.....	1000	fracture sq. across
2	84000	1.50	.....	1000	fracture sq. across
3	82200	1.55	.....	1000	fracture sq. across
4	83400	1.00	.....	1000	fracture sq. across
5	80000	0.90	.....	1000	fracture sq. across
Average	82000	1.23			
6	68800	1.25	.....	1200	fracture sq. across
7	74500	1.05	.....	1200	fracture sq. across
8	71900	1.20	.....	1200	fracture sq. across
9	75200	1.10	.....	1200	fracture sq. across
10	74300	1.00	.....	1200	fracture sq. across
Average	72900	1.12	.....		
11	79300	2.00	.....	1500	fracture sq. across
12	80500	2.00	4.00	1500	fracture sq. across
13	66300	.....	.....	1500	flaw
14	81900	2.00	.....	1500	fracture sq. across
15	85800	3.30	.....	1500	fracture sq. across
Average	78700	2.32	4.00		
16	85100	3.30	.....	1600	fracture sq. across
17	86600	2.87	.....	1600	fracture sq. across
18	89100	3.30	.....	1600	fracture sq. across
19	87500	3.30	5.63	1600	fracture sq. across
20	88700	2.87	.....	1600	fracture sq. across
Average	87400	3.13	5.63		
21	95500	10.00	.....	1700	fracture sq. across
22	96600	10.65	16.15	1700	fracture sq. across
23	97800	9.80	.....	1700	fracture sq. across
24	99400	10.00	.....	1700	fracture sq. across
25	97400	.....	.....	1700	broke outside punch marks
Average	97300	10.11	16.15		
26	94000	.....	.....	1750	fracture sq. across
27	103000	13.30	18.50	1750	fracture sq. across
28	98000	13.30	18.50	1750	fracture sq. across
29	93700	.....	.....	1750	gas pocket
30	103000	14.00	17.10	1750	
Average	98300	13.53	18.03		
31	124000	26.60	27.20	1800	irregular fracture
32	116000	.....	.....	1800	flaw
33	121000	24.60	26.80	1800	
Average	120300	25.60	27.00		
34	111600	24.00	.....	1850	irregular fracture
35	120500	28.65	29.90	1850	irregular fracture
36	117300	.....	.....	1850	gas pocket
37	117200	.....	.....	1850	
Average	116600	26.32	29.90		
38	119700	.....	.....	1900	blow hole.
39	129300	36.00	35.20	1900	½ cup fracture
40	124500	33.30	.....	1900	½ cup fracture
41	128500	38.70	37.50	1900	½ cup fracture
Average	125500	36.00	36.35		
42	122000	34.70	34.00	1950	¾ cup fracture
43	117000	29.30	29.30	1950	¾ cup fracture
44	120500	31.30	37.00	1950	¾ cup fracture
45	126400	35.30	42.30	1950	¾ cup fracture
46	127000	.....	.....	1950	¾ cup fracture
Average	122600	32.65	35.65		
47	123300	34.00	36.90	2000	¾ cup fracture
48	125200	35.30	.....	2000	¾ cup fracture
49	120500	34.60	38.70	2000	¾ cup fracture
Average	123000	34.63	37.80		

to 2000 degrees Fahr. Charging of the bars was done after the furnace had attained the desired temperature. All bars were soaked for a period of 20 minutes and then quenched in running water, after which they were ground to 0.505-inch in diameter for a distance of 2 inches. Specimens for metallographic analysis were taken from unstrained sections of the tensile bars.

Chemical analysis obtained from composite chips machined from tensile specimens is as follows:

Element	Per Cent
Carbon	1.24
Manganese	12.20
Chromium	.65
Silicon	.61

The results of physical tests may be found in Table VI. The average physical properties for the various quenching temperatures were used in visualizing the results as depicted in Fig. 27.

The micrographs show the average structures of specimens selected from each lot.

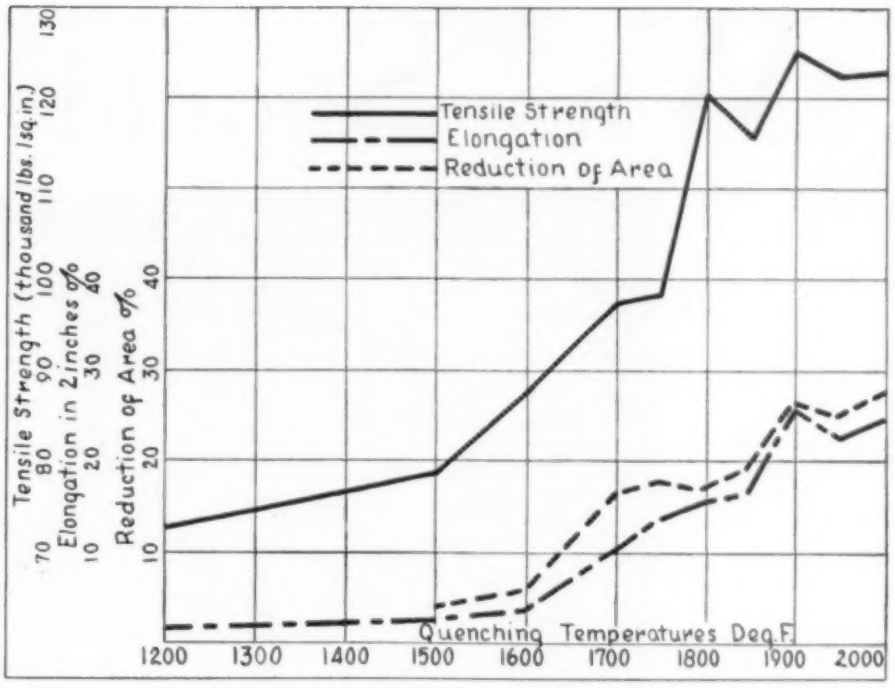


FIG. 27—CURVE GIVING THE AVERAGE DATA FROM THE PHYSICAL TESTS ENUMERATED IN TABLE VI

By referring to Fig. 27 it may be seen that as the quenching temperature is increased. an improvement in the physical characteristics is manifested, reaching a maximum at 1900 degrees Fahr. At 1950 degrees a slight drop in the physical properties occurs and at 2000 degrees there is again a slight increase, yet somewhat below those prevalent at 1900 degrees.

Physical tests are no criterion by which to judge the resultant effect of changes actually occurring within the speciment due to application of heat other than to permit of approximate and relative deductions as to reactions actually occurring. Therefore, as a final check as to the actual changes taking place within the steel, we must resort to an analysis of the microstructure. A representative specimen as chosen from each lot to show the average structure at 200 and 1000 diameters magnifications and these are shown in Figs. 5 to 26.

The only significance of the low power magnifications is to show grain sizes peculiar to the various temperatures and to serve as a comparison, whereas, the higher magnifications assist in locating the last traces of free carbide. It is noted that as the temperature was increased the carbides were gradually broken up and dissolved. Fig. 11 reveals a much finer grain structure than any of the others. This is true because of the readjustment taking place in going through the critical range which, in the case of this particular steel, probably occurred between 1550 and 1600 degrees Fahr. This temperature, however, was not great enough to effect a complete solution of all the carbides.

Higher power magnifications show clearly the character of the carbides. By referring to Fig. 20, which represents the specimen quenched from 1850 degrees Fahr., it will be noted that large areas of undissolved carbides are still present. However, at 1900 degrees (Fig. 21) complete solution has taken place. Although no data has been given which shows the effect of heating to 1875 degrees Fahr., it is deduced that the reaction took place between 1875 and 1900 degrees.

Manganese steel, when tested in tension, ordinarily stretches uniformly along the whole gage length and immediately before fracture reveals cracks all along the outer surface. Likewise, the reduction in area is almost uniform along the full gage length. By referring again to Table VI under remarks it is noted that all bars heated below 1850 degrees Fahr. broke square across. At 1850 degrees Fahr the fracture was somewhat irregular and at 1900 degrees Fahr. the specimen necked to a ½-cup, which is indicative of greater toughness. The specimens quenched from 1950 and 2000 degrees Fahr. resulted in a ¾-cup fracture.

This investigation has shown that an increase in carbon content over 1 per cent requires a correspondingly higher temperature to effect complete solution of the carbides. The temperature necessary for a steel containing 1.24 per cent carbon and 12.20 per cent manganese to bring about the desired effect is in excess of 1850 degrees Fahr. preferably between 1875 and 1950 degrees. By quenching from this range the following improvements in the quality of manganese steel may be obtained: Increase in tensile strength; increase in toughness; increase in ductility; alleviation of condition of chipping or flaking, and greater resistance under impact.

All of these characteristics may be attributed to the elimination of the brittle constituents by absorption to form a homogeneous solid solution at elevated temperatures and preserving these equilibrium conditions by rapid quenching in water.

Rhode Island Malleable Foundries Merge

The Rhode Island Malleable Iron Works, Hillsgrove, R. I., has purchased the capital stock of the Rhode Island Fittings Co., Providence, R. I. The new consolidation is capitalized at well over a million dollars. The Rhode Island Malleable Iron Works is a jobbing foundry making all kinds of castings. For many years it has specialized in the manufacture of pipe union castings. The Rhode Island Fittings Co., will continue to be operated as a separate unit and the officers will be practically the same as for the Rhode Island Malleable Works. These officers are: Charles Brown, president; C. P. Clough, vice-president; H. L. Steeves, treasurer and general manager; and E. E. Grinnell, secretary. The consolidation will give the Rhode Island malleable Iron Works, larger resources.

Who Should Train Apprentices?

This is the second and concluding section of an article dealing with the fundamentals of installing an apprenticeship system in a large steel foundry.

"—we must plan separate courses for the regular apprentice, for the young man who has graduated from high school and for the college graduate."

BY C. J. FREUND

BENTON, the new apprentice director, readily became acquainted with officials, foremen and men in the organization. He had a friendly personality, was helpful but not officious, and minded his own business. Under direction of the works manager he made a careful survey and study of apprentice courses established in the district, and by letters and trips, he learned about successful plans in operation at greater distances. To the works manager he presented a complete set of notes on his observations and after the works manager and superintendent had studied these notes, a meeting was called in the works manager's office to discuss the apprenticeship undertaking.

The group included the works manager, superintendent and his assistant, apprentice director, foremen and assistant foremen of the heavy jobbing department, light jobbing department and machine molding department, foremen of the core room and bench who had no regular assistants. The meet- also was attended by the metallurgist and the head melter.

The works manager stated that the meeting had been called for the purpose of drawing up work schedules for the men on apprentice courses.

"I thought that was Benton's job," the light jobbing foreman sang out immediately, "he has been studying this thing and probably knows more about it than we do."

"I don't think he does know more about it than you do," replied the works manager. "You are trained foundry mechanics and he is not. You know what constitutes foundry skill and you know what kind of work must be done to acquire it. He will get your ideas together and organize them but the ideas must be yours. Nothing will go into the work schedules for the apprentices unless you all agree that it belongs there."

"Suppose we all agree on something," asked the core room foreman, "and later find out we are all wrong?"

"Then we shall meet again and change it. We have a lot of notes which show what other people have done in apprenticeship, but the final plan must be our own although based on other people's experience.

"Before we definitely decide on the length of time to be spent by apprentices on various operations and in various departments we must specify those operations and departments. In doing this, we must remember that we are to train all around foundrymen and not mere specialists. Also, we must plan separate courses for the regular apprentice, for the young man who has graduated from high school and for the college graduate."

Helping molders was the first item considered. It was agreed without discussion that every apprentice should spend some time as a helper, to familiarize himself with the materials in use in the foundry and the need for co-operation between molder and assistant. Similarly, it was agreed that an extended period of green sand molding should form an important part of every apprentice work program.

Inclusion of machine molding in the course brought on a lively discussion.

"Machine molding," scoffed the foreman of that department, "who ever heard of putting an apprentice on a molding machine?"

"A great many foundries include a period of machine molding in their contracts," Benton explained.

"What for?" the production foreman persisted. "You don't expect to get a machine operator when you hire a first-class molder. There is nothing for an apprentice on the production floor; it is the same thing over and over. I can break in a green man in

a month or two and I don't need or want a first-class all around molder. A machine molder is out for the money; he doesn't care about the trade."

"Hold on," argued the works manager. "You can't judge what will be expected of a good foundryman six or seven years in the future by what you expect of him now. More and more machine work is coming into the foundry and the foundrymen of the future must be familiar with development in this direction.

"I can't see it at all. It is a waste of time. If you teach the apprentice the essentials of foundry work, he can pick up the machine work quickly enough if he has to." The production foreman looked around hopefully for confirmation of his views.

"I haven't given the matter much thought," said the assistant superintendent, "but I think this question ought to be settled on the basis of what we expect of an all around foundryman. I am sure we all agree that when a man comes in and claims that he is a first rate foundryman with general experience, we take it for granted that he knows something about machine molding. If our apprentice courses are to make first rate foundrymen, they ought to include work on the machines."

"I haven't more than two or three high-grade mechanics in my whole department." The production foreman advanced this as a clincher.

"How about yourself?" countered the apprentice director. "If you were to start all over, would you accept an apprentice training course without machine work in the light of what you know now?"

"Well," answered the production foreman uncertainly, "I don't know!" Gradually, as the argument continued, the production foreman found himself alone in his opinions. Most of the others took their turn in answering the objections he made. His firm conviction that the apprentice should avoid machine work slowly changed to a suspicion that he might be wrong. From that point it was easy. Before long it was agreed unanimously that all apprentices should spend a period on molding machines.

The hour assigned for the meeting passed too quickly to settle all points. After much discussion at subsequent meetings it was determined that general foundry apprentices should spend a period of time in the core room, that coremaker apprentices should spend some time at molding, that general apprentices should do a certain amount of furnace work and that every apprentice should attend school for theoretical instruction no less than one-half day per week during the school year and that he should be paid for time spent at school.

Foremen Teach Apprentices

Several months passed before the schedules were made up fully. Schedules were drawn up not only for regular four-year courses but special programs were adopted for young men who had completed high school and college courses. When the work schedules were completed, six more weeks of planning and discussion were devoted to the preparation of schedules of pay for the various apprentice courses.

Contracts finally arranged represented the thought and experience of the foremen which was as it should be. As the works manager pointed out, the foremen were to teach the apprentices, and they hardly could be expected to teach anything that they themselves did not consider essential. Neither could they be held responsible for turning out first rate foundrymen if any feature of instruction which they considered necessary were omitted. While opinions among the foremen did not originally coincide, the discussions brought about a general agreement and in time all the foremen were anxious to begin the actual training of apprentices, more particularly because they had outlined the training courses.

The apprentice director had been at work nearly a year on contract forms, employment records, and apprentice time sheets before the first apprentice was hired. The enterprise developed rapidly and the first apprentice had 25 or 30 companions inside six months.

Some time after the apprentice training program was well under way, the works manager entertained a visitor friend who had heard of the success of the project and had come to investigate. He was anxious to learn of the methods employed in administering the course.

"I cannot understand," said the visitor, "how you can depend upon foremen for teaching the trade. Teaching is a profession with a definite technique like any other profession. Certainly your foremen have not this technique."

"My foremen are not professional teachers," the works manager admitted, "but nevertheless they are good instructors in foundry practice. Although none of them has in his mind an organized body of knowledge and none of them could write out or even think out a continuous course of foundry instruction, this lack is balanced by the opportunities they have for practical demonstration, based upon the difficulties which constantly arise and the questions which the apprentices ask.

"The instructor in high school or college makes use of demonstrations whenever he can to illustrate his lectures and these demonstrations give force to his teaching. Demonstrations in a school course are necessarily few in number. The foreman is surrounded by demonstrations. He cannot escape them. He can utilize only a small percentage of them. He needs to do nothing except explain to his apprentices the various phenomena as they occur, to give a first rate course in foundry practice; a course much better than could be given in a lecture room by the most highly trained teacher.

"—instruction may not be formal and regular but it is graphic and effective."

Our instruction may not be formal and regular but it is graphic and effective. Come into the shop and perhaps I can show you what I mean."

They entered the foundry and almost immediately found the foreman of the small jobbing department with one of his apprentices examining a casting on the scrap pile. The casting was a frame made up of two heavy parallel rails joined by several wide cross members. It was the old story. Cracks showed where the cross members joined the rails. The works manager and his guest approached unobserved.

"—the foreman's instructions have caused an increased efficiency in the shop."

"There's a nice hunk of scrap due to ignorance or carelessness," the foreman was saying to the apprentice. "Steel shrinks while it cools and the part of the casting that cools the fastest is the part that shrinks the fastest. This thick rail on the side stays hot for a long time and the cross pieces which are thin and spread out, cool much more quickly. For that reason the cross pieces shrink first and because they shrink first they pull away from the hot rail and that makes the crack."

"But you told me once," the apprentice replied, "that the chill rods are put in those places to cool the thick part sooner, and just as fast as the thin part, so that the casting won't crack. I put chills in there the way you said I should have them."

"You didn't have 'em in the right place," said the foreman. "Come back to your floor and I'll show you what's the matter right in the drag you are making now."

They started for the floor and the foreman noticed that the works manager had been watching and listening. He became slightly confused but the works manager told him to go right ahead and that he would come along to see the job. They found the chill rods were exactly where the foreman had anticipated, practically in the thin section where they could do nothing except hasten the cooling of the thin section and make the cracks worse than they would be with no chills whatever. The foreman showed the boy how to set them out into the rail, adjacent to the thin cross members. He told him he would have no further trouble with the chills in that position and again explained the reason why.

"There," asked the works manager of his friend as they moved away, "could you want any better teaching than that?"

"It is quite effective, I'll admit," the friend admitted, "but how about production? This explaining must take a lot of the foreman's time. This demonstration took at least 10 minutes."

"We have no production difficulties. On account of the foremen's instructions we have had such an increased efficiency in the shop and such a reduction in scrap that we have discarded the old method of hustling and crowding by the foremen and have substituted the sort of thing you have just seen. It pays better."

About three months ago the works manager came into the superintendent's office.

"How about those Acme pump frames?" he asked. "I was thinking about them because I just saw Henry come out of the hospital with his hand tied up. He told me he had struck it with a hammer and the doctor had sent him home for a few days."

"I am sorry for Henry," replied the superintendent, "but his accident won't affect our schedule. Henry usually made them but Herman Bender can make them as well and I know that one of the boys can make them, too."

"But that takes Herman off the housings and we can't stop production on them."

"Oh, three or four of the apprentices can make the housings. We are all set. There is nothing to worry about."

"That's fine," said the works manager as he turned to go. Suddenly he stopped.

"I told you it would work," he said.

"Told me what would work?" asked the superintendent in surprise.

"Do you remember what started all this apprentice work in our shop?"

"Pump frames and housings," replied the superintendent after a moment's thought. "Times have changed, haven't they?"

"You may tell the world for me they certainly have." The works manager grinned. "Now what is the next job?"

Investigates Ductility in Steel Castings

In co-operation with research associates from the Steel Castings Development bureau and the bureau of standards has begun work on the causes of low ductility in steel castings. Preliminary work has been done on methods of testing the ability of metals to fill a mold during casting.

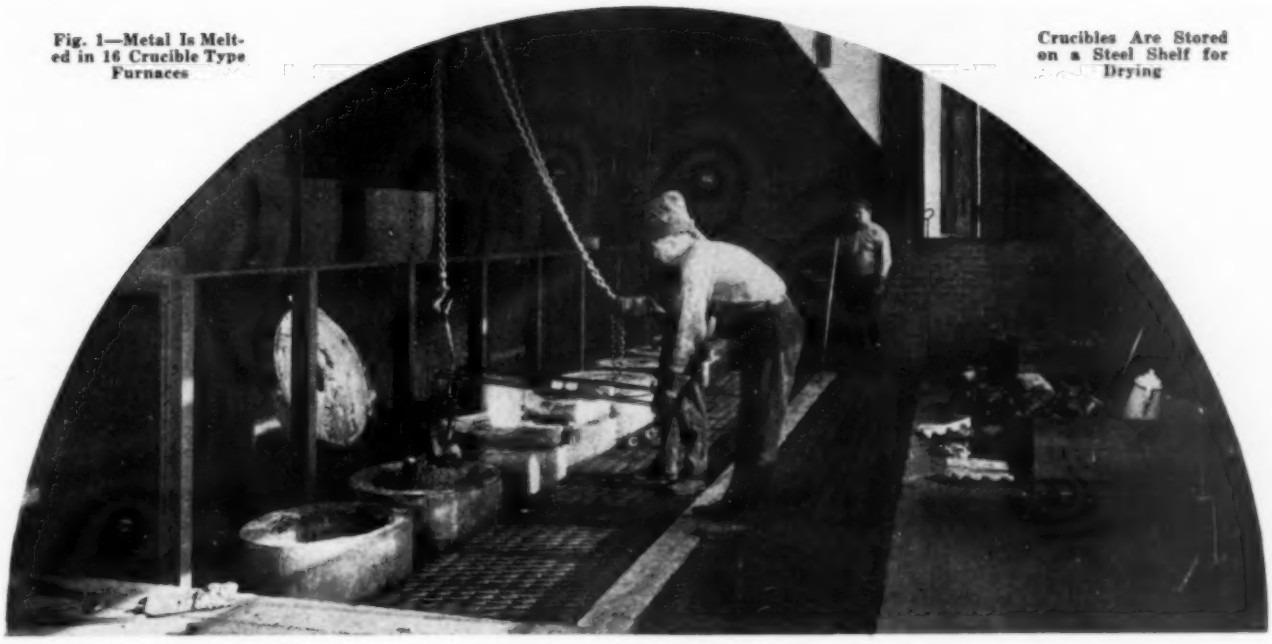
Equipment Orders Gain

The index of gross orders for foundry equipment in November was 197.8 as compared with 185.0 in October according to a recent report of the Foundry Equipment Manufacturers' association. The index of shipments in November was 264.0 as compared with 254.3 for October. Unfilled orders showed 403.9 for November against 462.6 for October. The base is the average monthly shipments for the years 1922-23-24. Comparisons of monthly orders as presented by the association follow:

	1924	1925	1926	1927	1928
Jan.	141.8	104.2	168.2	180.4	132.7
Feb.	121.0	108.8	154.9	198.0	123.6
March	121.9	159.3	157.3	131.1	138.6
April	146.8	124.3	113.2	130.0	107.7
May	108.0	113.3	128.5	134.8	335.6
June	96.4	110.5	133.5	138.4	149.1
July	62.8	117.0	127.3	89.9	94.8
Aug.	77.5	190.0	141.2	106.4	278.0
Sept.	66.0	94.2	114.0	80.4	170.0
Oct.	85.5	149.5	140.5	98.0	185.0
Nov.	91.4	180.3	133.4	95.8	197.8
Dec.	137.8	140.1	181.0	106.8	.....

Fig. 1—Metal Is Melted in 16 Crucible Type Furnaces

Crucibles Are Stored on a Steel Shelf for Drying



Builds Nonferrous Foundry

To Cast Quality Work

By Fred B. Pletcher

SOME time ago, before the Hills-McCanna Co., Chicago, sold its old plant on Elston avenue, which it occupied for ten years, the management of the company decided to build a new unit in which it would be possible to produce the same high quality castings with less hand labor, thus permitting greater economies and an increase in production capacity. To that end every contributing factor was given careful consideration and a thorough study was made of various types of labor-saving equipment and methods before the new foundry was designed an l built. The Hills-McCanna Co. specializes in nonferrous castings which may be considered exceptionally difficult to cast. The company produces a class of castings which ordinarily is not attempted by the small jobbing brass foundry. Much of the work is produced to meet exacting chemical and physical specifications which are submitted by the customer and include such factors as resistance to corrosion and wear, as well as conditions arising under severe service. Many castings also are made on government specification. The company produces castings of numerous nonferrous alloys, including brass, bronze, copper-aluminum-iron, nickel-copper, copper-nickel-iron, chromium alloys and monel metal.

Products manufactured include gears, bushings, bearings, acid line fittings, pump parts, propeller shafts and valve trimmings. In addition many castings are made which are used in products manufactured by the Hills-McCanna Co. A large percentage of the products of the Hills-McCanna foundry are finished in the plant, the company offering service from pattern to finished part. The company is equipped to cast any severe service parts up to 3 tons in weight. To meet this requirement and to eliminate back-handling of materials, the two main plant buildings are constructed at right angles. The machine shop, shipping and stock rooms, laboratory and offices are in the east and west section, and the molding floors, core ovens, cleaning department, furnace and materials storage rooms are located in the north-south section. Each of the two buildings comprising the L are approximately 66 x 200 feet. Mixtures

FIG. 2—AN OVERHEAD MONORAIL SYSTEM IS USED TO HANDLE MATERIALS IN THE SHIPPING DEPARTMENT

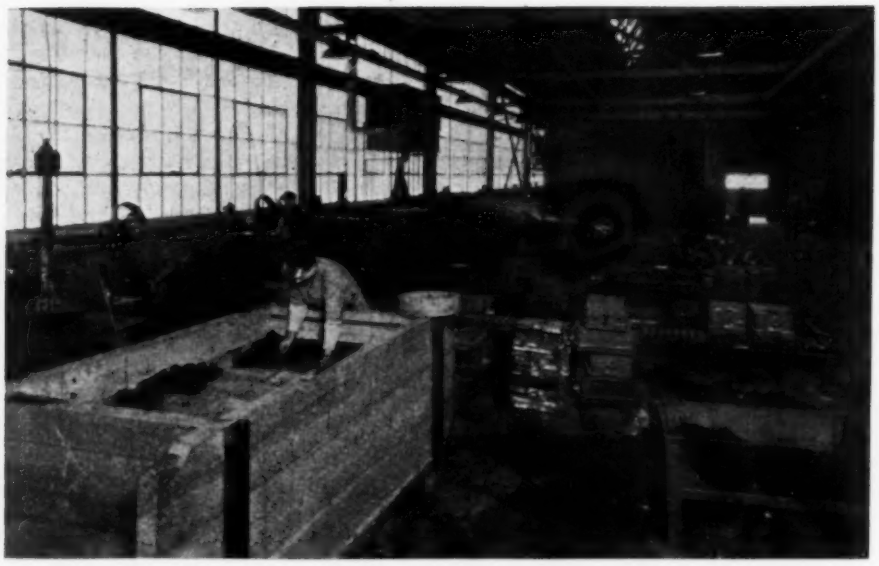


FIG. 3—ONE SECTION OF THE MOLDING FLOOR SHOWING METHOD OF HANDLING THE MOLDS

for the charges have been the subject of much study and experimental work. No scrap is used except the gates, sprues and risers from the casting operations in the foundry. Borings from the plant's machine shop are not included in the scrap melted, as it had been found more difficult to control the mixtures when borings and foreign scrap are used.

Difficulties have been encountered in the past with the segregation of borings. Therefore for the purposes of control and to assure the desired quality of the metals for specific requirements, the mixtures are confined entirely to virgin metals and returned scrap. Red metals are used in the mixtures only for castings bearing metals and gears for the company's own use.

In melting the copper-aluminum-iron metals, varying amounts of each constituent are used in the charge, depending upon the analysis desired. The charges for the nickel-copper and copper-nickel-iron, chromium and monel products, likewise vary with the different applications for the finished castings. In some cases the nickel varies from pure nickel down. Considerable monel metal is being used for certain classes of work, with the admixture of other metals and alloys. The work of the furnace room and the molding floors ties up closely with the chemical laboratory and each heat is made the subject of analytical study in the laboratory.

One of the important methods adapted to eliminate back-handling and to provide for the passing of the work in an unbroken circuit is the lift truck system, manufactured by the Barrett-Cravens Co., Chicago. After the work is shaken from the sand it does not touch the floor through the remaining foundry processes. All lift boxes and trucks used throughout the plant are interchangeable. While metal boxes are used on the molding floors for handling castings immediately after they are shaken out, wooden boxes are used in handling all other materials on lift trucks. Several of the wooden boxes are shown in Figs. 2 and 5. The work passes from one truck to another through the cleaning, inspection, machining, storage and shipping departments.

The furnace room, shown in Fig. 1, is a model of compact arrangement, built to permit the most advantageous use of men and materials. The department is featured by the clean appearance and excellent system of ventilation. The furnace room is located at the south end of the foundry building, a brick wall separating the furnace room from the molding floor. Melting time is from 55 minutes to an hour. Metal is melted in 16 crucible-type pit-fired, oil-burning furnaces. The pots used are of 150 and 200-pound capacity. However, the pots are made especially for use by the Hills-McCanna Co. to meet special melting requirements. The life of some of the pots runs from 6 to 12 heats although some have withstood 28 to 32 heats. It is considered an exceptionally good record when the pots may be used for 32 heats, except when red metals are used and then a greater number of heats are secured. The furnaces are fed with 26 to 28 gravity (Beaume degrees) oil under 50-pound pressure through oil burners made by the North American Mfg. Co., Cleveland. The air mixture is of 12-ounce pressure fed by fans manufactured by the North American Blower Co., Cleveland.

The furnace room is ventilated by suction fans placed in the roof directly above the furnace pits. The fans are capable of producing a maximum suction of 46,000 cubic feet of air per minute. The furnace room gases thus are drawn directly upward through large hoods suspended above each furnace, and pass out of the room through four openings in the roof. The fans were manufactured by the New York Blower Co., Chicago.

Crucibles are stored on a heavy steel shelving placed against the wall, above and to the rear of the furnace pits. When placed on the shelf, as illustrated in Fig. 1, and allowed to remain the predetermined length of time, the crucibles are annealed. Crucibles are prevented from drawing moisture since the shelf is six feet above the pit bottom. The tops

FIG. 4—TWO OVENS ARE USED TO BAKE THE CORES REQUIRED IN THE PLANT

of the furnaces are level with the concrete floor. Operators stand on steel grating laid in front of the furnaces. As shown in Fig. 1, two pits in front of the furnaces are covered with the steel grating. The pit nearest the furnaces contains the burners and the one farther back encloses the blowers. A concrete wall between the burners and blowers protects the blowers and motors from excessive heat.

Another noteworthy feature of the furnace room is the protection provided against the accidental breaking of crucibles in the furnace. Ingot molds are arranged under the slag holes at the rear of the furnaces to receive the metal in case of damage to the crucibles.

An overhead carrier system of 1-ton capacity operates over the furnace pits, as shown in Fig. 1. After the crucible is lifted out, it may be carried over the system the full length of the main foundry floor which is at right angles to the furnace room. Two switches are located in the main bay so that the crucibles may be carried over bridges to the molding floors on either side of the center aisle. Two 1-ton cranes operate on the transfer bridges, one on either side, while a 5-ton crane serves the heavy molding floor and core oven department. Chain blocks are used on the crane hoists. The monorail and cranes were built by the Atlas-Chicago Co., Chicago.

The molding department on either side of the center aisle of the main foundry department, has space for 20 molding floors. The molding floors on one side of the building are shown in Fig. 3. No columns interfere with work on the foundry floors. Molders give their undivided attention to the production of molds, since the work of pouring, shaking out and sand preparation is performed by other crews. The floor, where large castings are molded, as shown in Fig. 3, is of earth so that the pit may be extended for certain classes of heavy casting work. The maximum capacity is approximately 15 tons daily. This is considered a high output for the type of castings produced.

Owing to the nature of the company's products, hand molding predominates. Two molders are used at the heavy casting pit. The small molds are prepared in metal flasks manufactured by the Sterling Wheelbarrow Co., Milwaukee. Four molding machines manufactured by the Arcade Mfg. Co., Freeport, Ill., are used. The pouring crew consists of three men.

Molding sand used conforms to standards set up by the company after years of molding experience. The finer grades of special sands are used. The sand used usually includes three grades of Albany sand, and for some work New Jersey sand is found most practical. The work runs largely to green sand molds, the sand being tempered and mixed by hand. Mechanical sand equipment consists of two electrically operated sand riddles supplied by the Foundry Equipment Co., Cleveland. Adjacent to the molding floors is the inside sand storage where adequate room is provided for three cars of sand.

The core room and ovens are at the north end of the main bay. While some intricate core work is required at times, the core-making department is not extensive. This is due to the fact that in much of the work produced, no cores are used. One man makes all of the cores used in the foundry. Two oil-fired core ovens, shown in Fig. 4, operate from a double burner, permitting one or both to be lighted at one time. The oil burner and the regulating valves are in a pit behind the ovens. Each oven is about 6 x 8 feet. One oven is used during the day to bake small cores and the other at night to bake larger cores and to dry molds. The day oven is of the drawer type and the various drawers may be loaded and emptied separately while the work on the other drawers is being dried. The night oven is of the car type. The core ovens were built by the Foundry Equipment Co., and the oil system by the North American Mfg. Co., Cleveland.

Oil lines to the furnace and oven burners are built to provide a constant circulation of hot oil, the return or overflow connection being made to the storage tanks. An oil-fired auxiliary hot water heater, which is connected with the oil heater, is installed for use when the low pressure boiler is out of service.

Some of the products, particularly those cast from the copper-aluminum-iron mixtures, are comparatively free from rough spots and require little cleaning. The cleaning department is across the aisle from the core room and ovens. The sprues and runners are removed by band saws and power hack saws supplied by Racine Tool & Machine Co., Racine, Wis. Several grinding machines are used to remove the fins from castings. The castings then are placed in a barrel type sandblast machine manufactured by the American Foundry Equipment Co., Mishawka, Ind. After sandblasting, the castings are inspected and carried by lift trucks to the machine shop in the other wing of the plant building.

FIG. 5—SAWS, GRINDERS AND SANDBLAST EQUIPMENT ARE USED IN CLEANING THE CASTINGS

While the pattern storage is comparatively small, it is completely fitted out with steel shelving for the patterns, and is considered as near fire-proof as can be accomplished. Records of patterns are filed under a card index system.

Metal received at the plant is unloaded on a truck-level platform and handled to the scales and the storage bins on roller conveyors. Returned sprues and runners, and the ingot metal, are stored according to analysis.

The shipping department has a 1-ton overhead conveyor system to serve from the receiving room and it crosses the heavy platform scales. The receiving and shipping platform and court are so arranged that the entire space may be enclosed and trucks loaded or unloaded during inclement weather do not expose the shipping department and machine shop to ex-

(*Concluded on Page* 90)

How and Why in Brass Founding

By Charles Vickers

Adds Antimony to Lead

We are contemplating the melting of some 11,000 pounds of lead into reels, which must be acid-resisting, as it will come in direct contact with sulphuric acid of medium strong solution. We are melting this lead in a crucible and will either pour into a sand mold or a chilled mold. We would like to know if there is an alloy we can add to this lead to make it tougher so that it will stand a little machining and which will not detract from the acid-resisting value of the lead.

Simply add 5 per cent of antimony to the lead. To do this get about 50 pounds of lead to a red heat then add the antimony, which will dissolve in the lead like sugar in water. The alloy will be too hot to pour, but after the remaining 45 per cent of lead has been added the temperature will be about correct. This amount of antimony will not harm the acid-resisting qualities of the lead, rather will it improve them. This alloy of lead and antimony can be cast in chilled or permanent molds more successfully than in sand molds.

Describes Type of Sand

We are figuring on making name plates and having heard so much about French sand we would like to know whether it is the proper sand for us to use and if so how to use it. If not, we would like a good dry sand facing for small work such as ornamental dies, name plates and branding irons.

We would not suggest the use of French sand for molding the castings mentioned as it is likely the results obtained would be inferior to what could be done with the regular heap sand. Peculiarities of French sand have to be understood thoroughly to use it to advantage. It might be advisable though, to obtain a couple barrels of Windsor Locks sand which can be ordered through your regular supply house.

The Windsor Locks sand can be used as a facing on the name plates, but when adding water to temper it, be careful and not add too much, otherwise it will not produce a smooth mold as it will roll like shot and pack in a similar manner. This applies to all facings. The regular heap sand when mixed about twenty parts to one of flour and used as a facing will make a smooth casting suitable for name plates. Some use pitch compound instead of flour, but this is a dirty material to use in a brass foundry sand. Flour has been used from time immemorial. It has been stated that Tubal Cain was the one who introduced it into the brass foundry.

Such sand will make a nice facing for ornamental dies, but it is advisable to *print back* such patterns. This is done most easily by taking the ornamental face off in the cope, then spray it with molasses water, next dust it quite thoroughly with *beam dust* or Windsor Locks sand applied through a flour bag, on top of the dusted sand. Dust with lycopodium, then return the cope and gently re-ram. Lift off and the impression ought to be perfect. Skin dry it with the torch before casting, and do not close the mold until the metal is within 5 minutes of pouring condition.

Castings Have Splits

We are sending for your observation a small casting that has been bent and broken to illustrate the difficulty we have encountered. This casting is shaped somewhat like a pill-box cover of oval shape, and is fitted with a short hub in the center which is half an inch in diameter and is cast solid and afterwards bored with a quarter-inch hole. The drill reveals that the casting has a split through the hub which radiates for a short distance into the thickness of the casting adjacent to the hub. Now what do you suppose causes that internal split? The alloy is 85-5-5-5. The castings are poured at the right temperature, and the gate is heavy enough for the work.

The alloy 85-5-5-5 is not addicted to showing such splits, like the alloys lower in tin and higher in zinc, comprising the cheap red brasses, but it will occur once in awhile as in the present case. The little solid hub is the thing to blame in this case as it extends into both cope and drag and is surrounded by thin metal. As the mold fills there is a slight check in the rate of metal flow as it dips down into the little drag depression and this results in forming a parting in this area, which is not eliminated when the flow is resumed, so we have a split.

Now although the metal was poured at the proper temperature, we suggest trying it at a little higher temperature and then see if the splits are not eliminated. Another thing is to examine the gates, or rather runners, with the idea of discovering whether it is not more bulky in the drag than in the cope. If it is, change this, for the correct proportion of gate or rather main runner should be one-third in the drag and two-thirds in the cope. If the gate is of proper proportion, then the splitting is simply a question of temperature, that's all. It might be advisable to remember that, while the first molds of a heat that were poured might catch metal of the proper temperature, if too long a string is cast, the last ones might roll up the production loss by simply splitting, due to cooler metal.

Alloy Contains Silicon

We have heard on several occasions about the use of a combination of metals introduced into aluminum that causes it to be nonshrinking. At this time we are much in need of such a metal to reproduce patterns reasonably accurate. You probably have the formula for making this material and if you will be so kind as to give us this information, as soon as you possibly can we will be grateful. We would also like to know how to harden jack stars.

We regret that we do not possess the formula mentioned in the inquiry, and we would be surprised to discover anyone else in possession of such a secret. There is no nonshrinkable alloy of aluminum commercially known, but there are alloys that thrink less than the ordinary alloys, and this is no doubt what is meant. Such an alloy contains 93 per cent aluminum, 4 per cent copper, and 3 per cent silicon. Both the copper and the silicon are conveniently added to the aluminum by using hardeners. One contains 50 per cent copper and 50 per cent aluminum. The other contains 50 per cent silicon and 50 per cent aluminum, or with higher aluminum and lower silicon to dissolve more easily. These hardeners may be obtained from dealers in aluminum alloys. We regret that we know of no method of hardening jack stars.

Melting Iron in the Cupola

By J.E.Hurst

Part X

REMELTING cast iron in the foundry cupola under normal circumstances generally results in an increase in the sulphur content. Continued remelting of the same material, for example, internal scrap of an individual foundry, conceivably might result in the increase of sulphur content to undesirable proportions. Foundrymen are divided into two clearly defined schools of opinion on the general harmfulness of sulphur in cast iron under ordinary conditions. Both schools agree that sulphur possibly may reach undesirable proportions, but they are not necessarily in agreement on the quantitative expression to be given to undesirable proportions. Necessity for attempting to reduce the sulphur content while remelting iron in the cupola depends upon the purpose for which the iron is intended, the importance attached to, and the amount of sulphur present. Sulphur normally is maintained within reasonable limits by the addition of limestone in the cupola. For specially reducing the sulphur to somewhat lower limits, addition of fluorspar or manganese oxides is recommended. In recent years several special processes for effecting desulphurization have come into existence and as these processes generally have involved the use of a receiver, they are worthy of special treatment at this stage.

Use of a basic electric furnace in conjunction with the cupola, now commonly known as the duplex process, has been described fully by various writers including the late G. K. Elliott whose exchange paper "Superheat in the Electric Furnace" appeared in THE FOUNDRY, Sept. 15, 1921. Undoubtedly this is the most effective method of bringing about desulphurization. The electric furnace superheats and refines the cast iron. The cupola does the initial melting of the iron, thus obviating high current consumption essential to initial melting in the electric furnace. The basic lined electric furnace of the arc type generally is used, and the molten metal is conveyed to it from the cupola in ladles.

Deal With Sulphur

DEALING with the process of desulphurization the author goes into considerable detail on the various methods and materials employed in the foundry for this purpose. Commencing with the operation of the electric furnace he explains the chemistry of sulphur reactions, alkali desulphurizers, mechanical slag separators and other desulphurizing agents. Method of employing desulphurizers is followed by a description of a special German device in which the metal in a receiver is jolted. It is claimed this action drives off occluded gases and produces a singularly close grained, solid metal with increased strength.

Molten metal is retained and superheated in the electric furnace in conjunction with an active lime slag and appreciable desulphurization is effected. Chemical reactions by which the sulphur is transferred to the slag are of a complex nature, but it is generally agreed that sulphur is taken up by slag in the form of calcium sulphide (CaS.). The following results given by Elliott are illustrative of the process of desulphurization in an iron rich in sulphur:

	Per Cent
As received from cupola	0.156
10 minutes in electric furnace	0.133
20 minutes in electric furnace	0.112
30 minutes in electric furnace	0.079
40 minutes in electric furnace	0.036
50 minutes in electric furnace	0.031
64 minutes in electric furnace	0.014

The Walter-Durkopp-Luyken-Rein process, a combination of various methods devised in Germany, utilizes alkali salts and alkaline earth salts to effect desulphurization. In its earliest form, the desulphurizing slag mixture was added to the molten metal contained in the ladle. Since these salts produce a covering of liquid slag on the surface of the metal, ladles of the teapot spout type are used, to prevent the inclusion of this slag when pouring metal into the molds.

This method was improved in German works by the adoption of various forms of totally enclosed receivers in which the desulphurizing operation was performed and these have culminated in the special design generally referred to as the Rein arrangement. This receiver erected close to the cupola is illustrated in Fig. 74. The connecting passage is arranged, after the manner already indicated in the description of the Ronceray brick, to separate the slag from the metal flowing into the receiver.

On a 40-inch diameter furnace melting about 6 tons per hour the height of the vertical passage leading to the receiver is about 5 inches and the sectional area 25 square inches. The horizontal passage connecting the receiver and cupola is 2¾ inches wide, 1¼ inches deep and 10 inches in length. The syphon passages presumably hold from 200 to 400 pounds of molten metal.

The Rein construction differs somewhat from the foregoing in that metal and slag flowing from the cupola are deflected to a similar separator

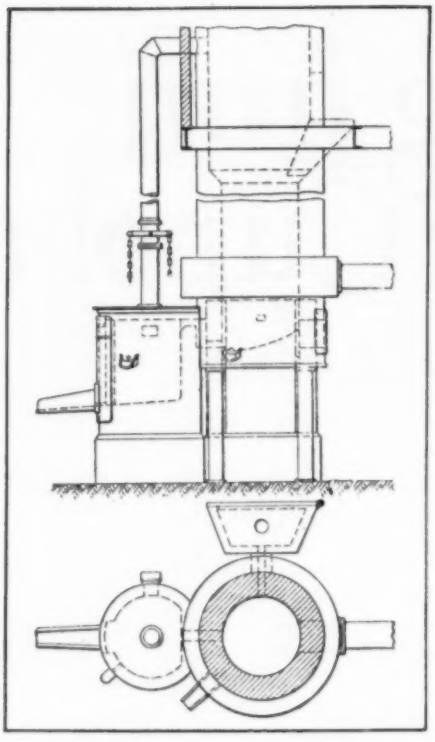


FIG. 74—CUPOLA WITH DESULPHURIZATION FOREHEARTH, DURKOPP-LUYKEN OVERFLOW AND REIN SLAG RECEIVER

arranged in the wall of the receiver. Slag is deflected to a slag box situated outside and adjoining the receiver. Metal flows into the receiver free from slag, an essential factor where desulphurization is to be effected by alkali mixture additions.

Brickwork of the fore-hearth and the overflow demands special attention. Ordinary hard-burnt side-arched brick has proved most resistant. Special bricks are not necessary. An alumina content of 40 to 42 per cent is desirable. However, it is essential that the bricks shall be burnt thoroughly. The bricks should be fitted as closely as possible to avoid large joints. The joints themselves should be packed carefully with the same brick substance. The sulphur slag must be prevented from finding large points of attack in the fore-hearth. Molded bricks made to a special design, according to the circumstances are more suitable for the overflow.

Lower half of the fore-hearth in the furnaces of the Durkopp foundry, is well grouted with a thin loam mortar after every run. Ground fragments of graphite are mixed with the mortar and this materially increases the durability of the fore-hearth lining. For some four or five weeks no additional work worth mentioning is necessary. However, any cracks which develop must be repaired before they get larger.

Cupola slag separated from the metal flowing into the desulphurizing receiver is collected in a separate slag receiver indicated in Fig. 74. The slag receiver on the cupola must not be opened immediately after the run is finished. The solid block of slag is not removed until the following morning. Large furnaces with a daily melting capacity of 50 tons or more form an exception. Periodic tapping of the furnace slag is desirable, and the doors may be opened sooner—that is, after a few hours. It is advisable to have a special slag receiver for each furnace. The inside of the receiver—the iron plates—are covered with a thin coat of loam each time after they are used. The fore-hearth should be preheated thoroughly before each melting, particularly if it has been repaired.

Use Soda Ash

Desulphurizing reagents consisting principally of soda ash are supplied in small blocks weighing about one pound. Generally speaking, an addition of about 0.5 per cent is sufficient and is claimed to decrease the sulphur content by 40 to 50 per cent. The addition is made as soon as the bottom of the receiver is covered with molten iron. Preferably the material is added in the crushed condition. Care must be taken to keep the fore-hearth as well filled as possible with iron to secure good desulphurization and maintain the iron at a uniformly high temperature. The level of metal in the receiver should not fall so low that slag collects in the tap-hole.

Application of the desulphurizing agent takes place in proportion as the iron is drawn from the fore-hearth. For every 1000 kilograms (2200 pounds) of iron drawn, about 5 kilograms (11 pounds) of desulphurizing briquets should be thrown into the fore-hearth. Addition of the agent then is continued according to the amount of iron required. The desulphurization slag should be thinly liquid and be in constant motion. The degasification generally is clearly visible. Viscous or inert slag indicates some defect in the brickwork of the fore-hearth, or sufficient desulphurizing briquets have not been added.

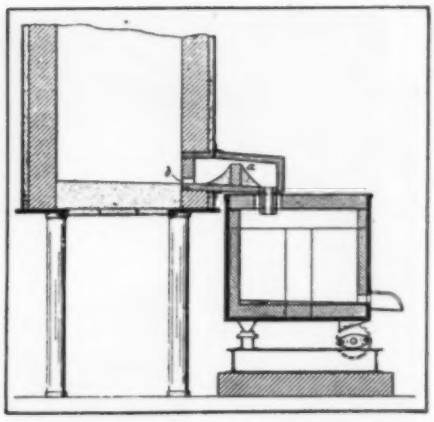


FIG. 76—DECHESNE TYPE JIGGER AND SHAKING RECEIVER IN SECTION

A special type of fore-hearth of receiver so arranged that the molten metal contained therein can be shaken or jolted, has been designed by Dechesne, and described in THE FOUNDRY, Oct. 1, 1926. This receiver is illustrated in Fig. 76, and a photographic reproduction of a modern installation is shown in Fig. 75. A simple slag separating device of the usual type is used at *a* and *b* Fig. 76. Jolting of the receiver is actuated by a rotating cam. The receiver is connected freely to the outlet of the slag separating device. The modern jolting installation illustrated in Fig. 75, shows the receiver

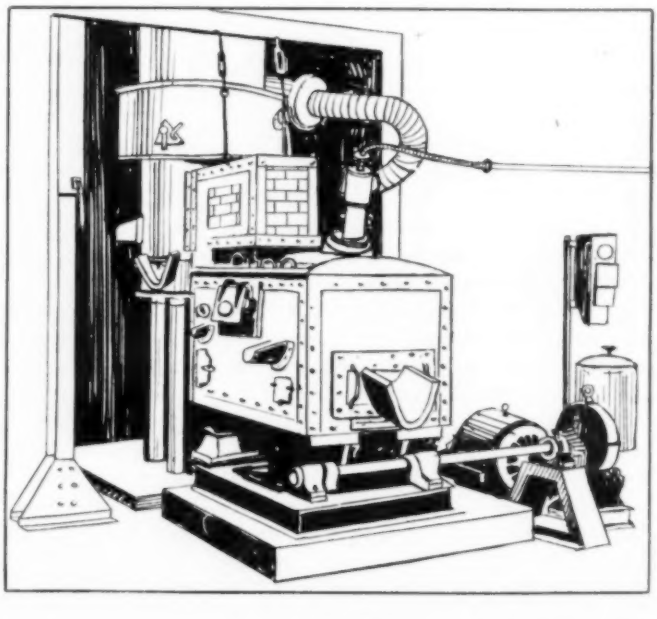


Fig. 75—The Receiver Is Hinged at the Back and Is Jolted by a Cam Arrangement Under the Front

with an oil burner operating off the cupola air supply. It is claimed that a thorough mixing of all components of the iron is obtained in the jolting receiver, and as a result of the removal of dissolved gases, a close grained, sound material is obtained having a considerably increased tensile strength.

The principal purpose of a receiver is to act as a reservoir, to maintain a constant supply of metal under widely varying demands of the foundry, and thus avoid the violent fluctuations in the working of the cupola, which would be necessary otherwise. Advisability of installing a receiver arrangement depends on particular requirements of the foundry. In a like manner, the same considerations will govern the choice. Successful working of any particular type invariably demands much closer attention to detail, and much more reasonable consideration than is given to many cupola plants today.

Rig Stripping Plate For Small Bracket

Question: We contemplate mounting two bracket patterns for machine production in a 12 x 26-inch flask as shown in the accompanying illustration. The pattern is symmetrical and is split through the center. We propose making the drags on a plain hand ram rollover machine. The copes are to be molded on a jar ram stripping plate machine. We intend to make our own pattern equipment and will appreciate your opinion on how to prepare the stripping plate for the cope. We understand that a cast iron plate is prepared a little larger than the outside dimensions of the flask. The plate is planed to a true surface on the upper side and provided with an opening that corresponds within about ½-inch to the contour of the pattern joint line. Nails project into this space which later is filled with babbitt, lead or some other soft metal. The pattern then is removed and the soft metal edge easily is filed to an easy fit. We have had no practical experience along this line and will appreciate definite advice on a few points.

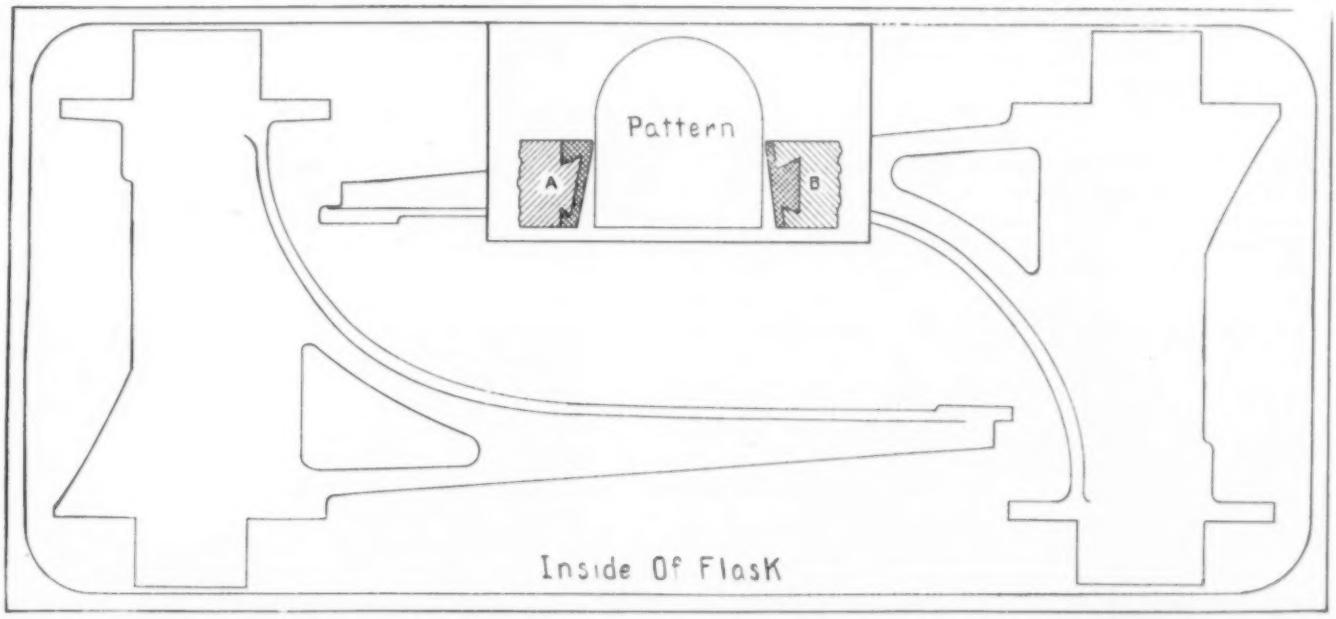
1—Is the inner edge of the plate straight, or is it provided with a step? 2—What distance is maintained between the nails? 3—What is the composition of the white metal usually employed for this purpose? Is the face of the white metal finished straight or chamfered where it adjoins the pattern?

Answer: We think you are inviting trouble by attempting a built-up plate containing two metals especially in the narrow spaces where the patterns almost touch. We see no reason why a plain cast iron or steel plate can not be cut and finished to the required shape. However, since apparently you have your mind set on the white metal lining we shall consider the preparation of the plate from that angle. If your cope patterns are already made, just the neat size and shape of the half pattern, one course of action will be necessary. If they are not yet made, they may be prepared in a manner that will reduce the total amount of work necessary and incidentally make better patterns than the first type mentioned.

Assuming that the stripping plate is to be 1-inch thick, then the joint face of the bracket pattern is produced 1-inch so that when eventually it is mounted on the machine the joint face of the pattern will coincide with the joint face of the stripping plate. This type of construction also provides a stiff solid pattern that lends itself readily to the stiff service to which it is subjected when the job goes into production.

A pattern for the stripping plate is prepared by sawing a suitable board to the required outside dimensions. Openings corresponding to the shape of the patterns are sawed on the inside. The openings are made larger than the patterns to provide space for the white metal lining. Nails sometimes are employed to retain the white metal lining, but a better method is to provide a dovetail in the face of the iron plate. This dovetail is formed with a number of small cores placed end to end and either may take the shape shown at *A* or that shown at *B*.

You do not state what facilities you have for locating the patterns in their proper relative position in the cope and drag so that the two halves of the mold will coincide when the mold is closed. In the event that you have a surface plate provided with center lines and pin holes, you may lay the patterns and stripping plate on the surface plate and then fill the space between with the white metal. This metal is made up from a mixture of zinc 2 parts, antimony 4 parts, tin 10 parts and lead 24 parts. The plate with the white metal in place is removed and the face is chamfered freely so that the pattern may slide up and down easily.



INSTEAD OF USING NAILS THE WHITE METAL LINING MAY BE ATTACHED TO THE FACE OF THE STRIPPING PLATE BY A DOVETAIL JOINT ACCORDING TO THE DESIGN SHOWN AT EITHER *A* OR *B* IN THE INSET

QUERIES ON FOUNDRY PRACTICE

Suggested Solutions for Common and Unique Shop Problems

Publish Information on Sand Reclamation

QUERY

One of our foreign friends is interested in the subject of sand reclamation and wants us to forward copies of articles that may have been published on the subject in this country. Are there any books available?

ANSWER

Several books have been published dealing with sand, but they have been confined to a discussion of its origin, classication, distribution, composition, use and methods of testing. So far as we know up to the present no book has been published dealing with the reconditioning of condemned molding sand. That is, sand in which the bond has been destroyed through exposure to metal at high temperatures and sand in which the individual grains have cracked and spalled under the same influence.

An immense amount of information on sand including its preparation, use and the description of one company's experience in salvaging old sand is contained in Part 2, Vol. XXXII *Transactions* of the American Foundrymen's association. This book of 400 pages was sent to each member of the association a few months after the Milwaukee convention where the material first was presented. For some time after publication extra copies were available and might be ordered from the secretary, C. E. Hoyt, 222 West Adams street, Chicago, for $2.

Articles on sand reclamation have been published in THE FOUNDRY on numerous occasions. For example in 1926 the index shows a total of 52 articles listed under the heading *Sand*. The majority of these directly and indirectly were concerned with methods and instances of sand reclamation. In 1927 the number was almost as great.

Probably the most complete dissertation on the subject, an impartial review of what has been attempted and what has been done, views of prominent foundrymen who favor the use of clay and of those who do not, was presented in a series of six articles entitled: "Can Used Sand Be Reclaimed?" which appeared in consecutive numbers of THE FOUNDRY from March 1 to May 15, 1926. The series was based on data supplied by a questionnaire sent by THE FOUNDRY to prominent foundrymen in all parts of the country, and on a personal investigation conducted by the author in several large foundries where clay had been substituted in whole or in part for the ordinary new sand employed in renewing the bond in the sand on the floor and in the facing sand.

Several manufacturers of clay products whose names may be found in the advertising pages of THE FOUNDRY have done considerable research work in sand reclamation and have interested many foundrymen in their product. They are glad to discuss the subject at any time with any person seeking information.

Favor a Concrete Floor in the Foundry

QUERY

Do you consider concrete a suitable material for a foundry floor?

ANSWER

Due to the introduction of the sand-cutting machine and the molding machine mounted on wheels for light work, the old time sand, clay or cinder floor rapidly is giving way to floors formed from a more rigid and permanent material. Wood block floors have been adopted to a considerable extent. Brick floors have been laid in many new foundries and in old foundries that have been rejuvenated. In some instances the bricks have been laid flat and level with the joints filled flush with mortar.

In others the entire upper surface has been covered with a thin smooth coating of cement. Concrete floors have been installed in many foundries in recent years and have rendered satisfactory service. Increasing use of industrial trucks has favored the introduction of concrete gangways in foundries where it is not considered advisable to lay the entire floor in concrete or other rigid material.

An exceedingly interesting paper dealing with the subject of concrete floors in the foundry was presented by H. H. Haley at the Philadelphia convention of the American Foundrymen's association held in 1919. This paper containing complete specifications for the construction of the floors is incorporated in the *Transactions* of the association, vol. 28, page 447.

Analysis of Sand Only One Test Feature

QUERY

What is the proper analysis of molding sand used in the production of medium weight and heavy gray iron castings?

ANSWER

You might just as well ask what is the standard length, width and thickness of a foundryman, as to ask for a standard sand analysis. Practically as much variation will be found in one set of specifications as in the other. As a matter of fact, chemical analysis by itself, is of little or no assistance in judging the fitness of sand as a molding medium. Thus in one section of the country you will find excellent castings made in a sand that shows a silica content of 90 per cent, while in another place the same result is secured in a sand with a silica content of 60 per cent. A prominent feature of nearly all sands found in the eastern states is that they are high in silica, quite open and may be rammed hard without endangering the casting. Many of the western sands under the same treatment would produce nothing but scrap. Rammed and vented properly these western sands are quite satisfactory. The physical condition of the sand, that is the amount and distribution of the bonding material, the size and shape of the grains and the amount of water present, are of greater importance than the chemical analysis. Typical analyses of two sands suitable for medium and fairly heavy castings follow:

SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Alkalies	SO_3
82.34	4.24	8.50	0.96	0.40	1.79	0.51
77.14	6.44	9.20	.....	0.91	1.10	.....

For interesting data on sand, its composition, and application in the foundry, also methods of testing, examination and control we suggest you secure a copy or copies of the various publications covering this subject. In one section of *Principles of Iron Founding*, Dr. Moldenke presents a practical treatise on molding sand. *Foundry Sands*, by E. W. Smith is a guide for the practical foundryman on the same subject. These books may be ordered through the office of THE FOUNDRY. The American Foundrymens association has published a great amount of literature on molding sand which also is available.

The FOUNDRY Family Photograph Album

Upper Left

W. S. ELLIOTT
Elliott Co., Pittsburgh

Lower Left

W. R. BEAN
Grindle Fuel Equipment Co., Harvey, Ill.

Upper Right

S. T. McCALL
American Manganese Steel Co., Chicago

Lower Right

J. W. HAYNES
Plano Foundry Co., Plano, Ill.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

NONFERROUS METAL SPECIFICATIONS

(Continued from Data Sheet No. 748)

Specification No. 62, Hard Cast Bronze

	Per Cent
Copper	86.00 to 89.00
Tin	9.00 to 11.00
Lead, max.	0.20
Iron, max.	0.06
Zinc	1.00 to 3.00

General Information: Good castings made of this bronze should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	30,000
Yield point, pounds per square inch	15,000
Elongation in 2 inches or proportionate gage length, per cent	14

This alloy is suitable wherever a strong general utility bronze is required. It may be used for severe working conditions where heavy pressures obtain, as in gears and bearings.

Specification No. 63, Leaded Gun Metal

	Per Cent
Copper	86.00 to 89.00
Tin	9.00 to 11.00
Phosphorus, max.	0.25
Zinc and Other Impurities, max.	0.50
Lead	1.00 to 2.50

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	30,000
Yield point, pounds per square inch	12,000
Elongation in 2 inches or proportionate gage length, per cent	10

Combining strength with fair machining qualities, this general utility bronze is especially good for bushings subjected to heavy loads and severe working conditions.

Specification No. 64, Phosphor Bronze

	Per Cent
Copper	78.50 to 81.50
Tin	9.00 to 11.00
Lead	9.00 to 11.00
Phosphorus	0.05 to 0.25
Zinc, max.	0.75
Other Impurities, max.	0.25

(Continued on Data Sheet No. 750)

NONFERROUS METAL SPECIFICATIONS

(Continued from Data Sheet No. 749)

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	25,000
Yield point, pounds per square inch	12,000
Elongation in 2 inches or proportionate gage length, per cent	8

This metal is an excellent composition for use where anti-friction qualities are desired, standing up exceedingly well under heavy loads and severe usage.

Specification No. 65, Phosphor Gear Bronze

	Per Cent
Copper	88.00 to 90.00
Tin	10.00 to 12.00
Phosphorus	0.10 to 0.30
Lead, Zinc and Other Impurities, max.	0.50

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	35,000
Yield point, pounds per square inch	20,000
Elongation in 2 inches or proportionate gage length, per cent	10

This is a hard bronze and may be used for gears and worm wheels where the requirements are severe.

Specification No. 66, Bronze Backing For Lined Bearings

	Per Cent
Copper	83.00 to 86.00
Tin	4.50 to 6.00
Lead	8.00 to 10.00
Zinc, max.	2.00
Impurities, max.	0.25

General Information: Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, pounds per square inch	25,000
Yield point, pounds per square inch	12,000
Elongation in 2 inches or proportionate gage length, per cent	8

This composition is recommended as an inexpensive but suitable alloy for bronze-backed bearings.

(Concluded on Data Sheet No. 751)

Analyses Market Conditions

Discusses Economic Conditions Before and After the Recent War, Gives the Solution to Present Marketing System and to Current Problems of Capital and Labor

By J. A. Marks

THERE has been a lot of discussion about ruinous competition, profitless prosperity, buyer's market, etc., that indicates that those who produce, manufacture or sell believe that the buyer is getting or is expecting to get too much for the money that he spends. When it is considered that the seller never thinks he is giving too little for the buyer's money, regardless of conditions, it is rather easy to understand why buyers generally do not take this situation seriously. However, it should be taken seriously, and should be discussed frankly and freely between all those who are interested in any phase of this industrial era.

Everyone now in business realizes that the present is a period of keen competition. Existing conditions are all well understood by business men. We are in this period of keen competition because there are more goods available, or more facilities for producing goods, than are needed to supply the demand of those who want or can buy.

War Stimulates Industry

Fourteen years ago the great war started and immediately there was created a demand for supplies that previously did not exist. At the same time the countries at war in Europe were hampered by the loss of the men who became soldiers. This country was called upon to supply materials at a greater volume than it had been called upon to do previously. After the first stimulation of our industrial structure by the warring European countries, America entered the conflict. Immediately industry was called upon for supplies for the army and navy. This condition continued to exist to the end of the struggle. The condition of false industrial stimulation continued for several years, for it was necessary to supply those demands that had been neglected during the war. Urgent needs of our civilian population had to be filled. Buildings had to be constructed, railroads rehabilitated, roads built, automobiles and farming machinery made, etc. So for a period it was thought that all the plants, machinery, coal, iron, food, etc., were needed in the same volume that we had been producing at the time during which goods were made to be destroyed by war.

We also must bear in mind that England, France, Italy and particularly Germany also expanded their facilities to support their armies and navies during a condition of emergency, and therefore that they are now in a new position to compete with America in supplying the world with peace time needs. When the neglected demand had been filled, the nation found itself producing more than it and the rest of the world could absorb. This country has been struggling to adjust itself to this condition ever since and probably will struggle several more years. The history of the periods following great wars has always been the same.

Thus there exists this so-called period of profitless prosperity. Manufacturers must meet this situation and might as well face it with minds resolved to solve the problem. Studying the facts at hand and the industrial history following other wars, it appears that the adjustment to supply what can be consumed rests on several factors.

Nothing short of another war would return industry immediately to the point where a demand would be created for the producing capacity which this country has now. It is hoped that the solution to the industrial problem is not in this direction.

The ideal solution to the problem is the stimulation of the demand for peace time goods by greater production per man employed and per dollar invested. The more labor and capital produces, the more they can consume. A workman employed efficiently and continuously buys not only his necessities but also has money to spend for luxuries and entertainment. At the same time capital is employed more continuously and profitably and its earnings are similarly available.

Solution to Problem

Labor and capital can be more efficiently employed. Those who have money to be used in business never object to its more intensive or continuous employment. Labor seems always to be afraid that it will have to give more of itself and is reluctant to accept any suggestion that involves greater effort. On the other hand any individual is ready and willing to apply himself intensively and continuously for what he considers suitable reward. The criticism for lack of efficiency does not reflect on labor but on those who employ and direct labor. It is human nature to do a job efficiently. A man always will find the easiest and best way to do his work if given free reign. We see this exemplified in those industrial organizations in which wage incentives are employed, particularly if the employes are given full advantage of their ingenuity.

Capital and labor make a great team if they are co-ordinated. Capital's part is to furnish the facilities with which labor can work efficiently. However, capital must not expect to take the whole advantage of this increased efficiency. If it does not share it with labor, the full effect is lost. It is to capital's double advantage to be fair and even generous with labor because the more labor earns the more it has to spend and the more it can then contribute to the general prosperity of the country.

There is another factor which will help correct the present situation. As time progresses and labor and capital work together for increased efficiency, new methods and new plant facilities are developed. As the plants whose machinery and buildings were built to

Solves Problems

THE author of this paper, which was presented at the Philadelphia convention of the American Foundrymen's association, is purchasing manager of the Packard Motor Car Co., Detroit. He analyses the phrase "profitless prosperity" so prevalent in the industry, explains the causes of the present marketing conditions, and tells how the situation may be remedied.

suit industries' needs ten years ago become unable to compete with the new ones, they fail, and thus eliminate the high cost producing factors in the problem. Likewise, the producing capacity is reduced and the level reached is nearer that in which the supply of goods is more nearly equal to the demand. At the same time the cost of goods is reduced.

Balance Is Fine

The balance between supply and demand is an extremely fine one. Consider an empty barrel being filled with water from a hose running a full stream. As long as the barrel is not full it will take all the water the hose will deliver, but as soon as the water reaches the top, it is full all at once. If the hose stream is shut off and a pail of water taken out of the barrel, the full hose stream can be again emptied into the barrel unit it is full again, but when the barrel is full it will not take another drop without running over. The condition of supply and demand is the same way. As long as the supply is less than demand and vice versa the situation is acute. The instant that the supply equals the demand the barrel is full and there is room for no more. It is not known how much the supply of any one commodity exceeds the demand but the minute the balance becomes equalized then this condition of keen competition will change.

Many managers now are taking business into their plants with the expectation of making very little if any profit just to keep their plants and organizations busy, and thereby prevent losses through overhead charges which continue whether or not their plants are busy. These managers are waiting for the barrel to become a bit empty. On the other hand, there are others in the same lines of business who are taking orders at the same prices and are making a profit, because they have developed greater efficiency in their plants. And this points to the best solution of the profitless prosperity problem.

One of the conditions which go hand in hand with over-stimulated prosperity is laxness in management. With plenty of business at profitable prices, there is a tendency toward nonimprovement of methods, close analysis of methods at the time not appearing necessary. Increased efficiency of labor is neglected. Salaries and wages are increased without obtaining increased results. A few years ago many managers were demanding men to help manage and direct their businesses which the managers felt was incapacitating them physically. The managers believed they needed more recreation. There was a demand for high-grade, capable men to whom industry was willing to pay large salaries. This was all right while those men were needed and industry could afford to pay them. Too many organizations still are trying to keep these men when the need for them has passed, in the hope that the conditions of their need will come again.

Many concerns now are operating profitably on low prices because they have trimmed extravagancies to the bone. They have thrown out obsolete equipment, eliminated inefficient labor, studied their methods and dispensed with all except those which are absolutely needed for efficient operation. They have given their labor opportunity and encouragement for economical and increased production per man and have eliminated every item of extravagance in management. Other concerns have not done this. Some have done part of it but not enough to make a profit on low-priced business.

Use Wrong Methods

Many producers or suppliers are criticizing the buyers for what they call "hand-to-mouth buying" methods and attribute a part of the present situation to the unsatisfactory situation arising from this practice. They argue that they are unable to produce economically without long contracts or large orders. It is true that continuous production is more economical than intermittent operation. On the other hand, there is nothing to be gained by continuous operation if it is followed by a period of complete cessation because of overproduction. The critics of the buying for current consumption now in vogue also argue that it subjects their trade to excessive and frequent competition because the buyers are continuously in the market. It must not be forgotten that prices will be established by the relation between supply and demand and that frequency of buying has nothing to do with it.

The practice of buying for current consumption is economically sound because it keeps capital more profitably employed. When large orders are placed for materials the recipient proceeds confident that the materials will be used at the rate specified in the order, and that he will receive another order before the first one is completed. He invests his capital in raw material, employs labor, and builds up his organization. If the materials are not used by the buyer as rapidly as anticipated his capital is forced to lie idle invested in unused material until conditions change and it is used. The policy of carefully studying and estimating needs over a short period in the future is growing. The practice of buying for current consumption and immediately working up materials into usable and salable products is increasing in industry. The automobile manufacturers were the leaders in developing this practice. A great amount of the material used in the manufacture of automobiles is received, manufactured and sold within a few days and the interest charges on the value of the goods are kept at a minimum. This is efficient employment of capital and is equally as important as efficient employment of labor.

Another factor contributing to more efficient use of capital is the speed of transportation. It is safe to say that the time during which goods are in transit is less than half what it was ten years ago.

What has been said has an important bearing on what the buyer expects for his money. The buyer will get what economic conditions determine he shall have. Those who are sellers must prepare to meet the condition of keen competition by studying the needs of the situation. Give the buyer what he wants and make a profit is the problem of the seller. There are certain essentials to his success which can be stated briefly. It is necessary in periods of keen competition for the successful and profitable business to buy wisely, limiting its commitments to economical quantities that will permit the most active employment of capital.

Studies Efficiency

The successful manager will study his methods of manufacture and will equip his plant with machinery and other facilities to give the highest efficiency. However, he must bear in mind that there is a balance between investment in plant and inventory, and must be careful lest his investment in plant reaches the point where the reduction in cost does not offset the increased interest and depreciation charges. Labor must be employed efficiently. The task for each workman must be accurately determined so that he will contribute his utmost within the limit of his capacity. However, labor must be rewarded fairly or this condition will not remain permanent.

Overhead must be carefully controlled. Those whose work does not appear directly in the product contribute importantly to the cost. Nonproductive or indirect labor should be as carefully studied and apportioned as the direct. The work of higher

(*Concluded on Page* 90)

Bill Reads About a Pattern Survey

By Pat Dwyer

BILL came in the other night to find me leafing idly through a magazine. Just at the moment of his arrival I had lighted on the picture of the upper works, the superstructure of a huge gentleman, bearing, with the exception of the head, a strong resemblance to a buffalo bull. To be strictly accurate, the fur also was missing, but no great stretch of the imagination was required to clothe the shoulders and chest with a luxuriant growth. Turn him loose on the open range for a season without comb, razor or mirror and I readily can believe he would sprout a mat impervious to a hydraulic stream. He could sleep on a barb wire fence or a cactus bed. The only kind of metal that would touch his skin would be a slug from a machine gun fired at close range.

The text under the picture contained an earnest, nay impassioned appeal to all 25 and 30 per cent men to take advantage of an offer guaranteed to turn them into red blooded, human dynamos, throbbing with restless energy, bubbling with enthusiasm, rarin' to go as the saying is and as hard as the hinges of—well, no I'll take that back. That expression was Bill's cynical contribution. The simile employed by the author was "as hard as a cast iron washboard." "A fat lot that guy knows about washboards," Bill remarked. "Cast iron ones, hey? Why do you waste your time reading that kind of junk?" "For the same reason," I replied, "that you often have wished you were behind the wheel on an armored tank. Here is a philanthropist who kindly offers to convert me into a combined personification of the late John L. Sullivan, Yusuf the terrible Turk, an auroch bull and a Kansas cyclone and you carelessly ask me why I am interested." "Forget that superman stuff," Bill advised patiently. "What you need is a few primary exercises in the development of the mind. The next thing I know you will be reading Peter Rabbit stories to me and dragging out your precious scrap book to show me the cute little letter you wrote to Santa Claus."

"Listen," I said. "You are prejudiced and like all prejudiced people you jump to conclusions. You have not read this—"

"I have read hundreds of 'em. They are all alike. They—"

"Wait a minute. Wait a minute 'til I read you an extract or two. This is different from the kind of stuff—"

"Stuff! I'll say it's stuff. Stuff and stufferino. You ain't goin' to stuff any of that into me. Read the drivel if it will relieve your mind. That is," he added doubtfully, "if a vacuum can feel relief."

All I ask is that you spend just 15 minutes each day in the privacy of your own room doing simple, easy, scientific movements under my careful direction. I'll take that body of yours and build it into something so wonderful, so impressive, so altogether beyond your fondest hopes that you'll gasp with astonishment when you look into a mirror at the end of 30 days.

"What do you think of that?" I inquired. "A few minutes each day, perfect privacy, simple, easy, scientific movements and in 30 days you won't know yourself."

"Well," said Bill, "I'll tell you. Any old time I get myself into such shape that I won't be able to know who I am, you may send for the keeper. The only time I look in a mirror is when I shave and certainly I have no ambition at the end of 30 days to find a perfect stranger gawking at me out of the glass. Gasp with astonishment? I'd be more apt to gash the old phiz.

"That 15 minutes a day in the privacy of your own room is a lot of baloney. A young bachelor living in a hotel might get away with it, but young bachelors notoriously enjoy the best of health and spirits. Then, if at any period of their existence they are in the pink of physical condition A course of setting up exercises is about as necessary to them as it would be to so many young goats. One of these lads might lock himself in his room for 15 minutes or for all day if he chose and no person would bother him, but what do you suppose would happen if I tried the same stunt? One by one, inside the first four minutes every single member of the family would discover that he or she needed something in the room. They would hammer on the door and demand admission. How could a man concentrate on the necessary movements—even though under the careful direction of a master—under these conditions? Manifestly in my undress uniform I could not

SOME ONE IS GOING TO GET A SWEET RECEPTION

open the door either to admit the mob or to throw them all downstairs. If I kept perfectly still and ignored the clamor they might become suspicious and send for the police or firemen to come and smash the door or window. The papers almost every day contain stories of the gallant fire laddies clapping pulmotors on birds who lock themselves in their rooms. No I'm afraid that 15 minute privacy clause puts me out of the running. What comes after that?"

I'll take those soft, skinny arms of yours and transform them almost over night into lithe, steel-like hooks of marvelous power and speed. I'll take the kinks out of that weak back—straighten it out—tighten it up around the waist—go over the lungs, the heart, the liver, the kidneys—strengthening—always strengthening. I'll take that weak, flabby stomach and make the muscles around it look and feel like a cast iron washboard.

"Apparently," Bill commented, "he is the champion long distance organ player and tuner. Pipes, pedals, case and keyboard repaired with neatness and despatch. Nothing said about trade-in values on old models. I think he is making a mistake there. Many a man who would hesitate at paying $10 for a new set of valves on an old blase and withered heart, gladly would pay anything for a new heart as soft and impressionable as the one he owned when he was twenty-one and thought he was tough.

The offer to transform skinny arms into, lithe, steel-like hooks of marvelous power and speed leaves me cold. If the statement had read: A good walloping right and left hook, I could see some sense in it, but I fail to see what practical use a pair of plain steel hooks would be to the average man. Suppose he was a baggage smasher and was confronted with the familiar sign USE NO HOOKS, why, he'd be up salt creek without a paddle.

"As for taking the kinks out of weak backs, straightening them out and tightening them up around the waist, that's old stuff in all the booby houses where the keepers clap the patients in strait jackets.

"This present reference is the first I have heard of cast iron washboard stomachs. That's what I call a distinctly original touch. The kind of skin you love to touch—with a mallet.

"Who wants a cast iron front? Certainly not the young man bidding his lady love a fond adieu. True love of course overlooks many things and modern young ladies—I am told—are made of sterner stuff than the gentle and charming girls you and I danced with on the old village green. Still I think even the most modern of the moderns would draw the line at being grabbed with a pair of steel hooks and pressed against a cast iron washboard. True love is true love the whole world over and you may lay to that, but lying against a cast iron washboard is something else, me lad. Love is blind, but not blind enough to appreciate black and blue bruises.

"With the family man, conditions are even worse. For several years his little pets have taken all kinds of liberties with his person from climbing on his knee to straddling his neck. Occasionally in their innocent merrymaking one of them rams a head in his paunch. Beyond a surprised grunt and an admonition—disregarded—to be more careful, no attention is paid to the incident.

EXPERT SEPARATES THE SHEEP FROM THE GOATS

"Then the misguided father sneaks away some place for 15 minutes every day and builds up this cast iron resistance belt. On the thirtieth day or night he stretches out in the old easy chair and an innocent victim creeps on to his lap. The hardened villain sounds no warning. His mind is on the steel hooks and the organs. He draws a deep breath of satisfaction and just at that moment the young cherub throws his head back with careless abandon. Instead of the familiar old cushion, the head lands with a resounding bang on the iron corrugations. The kid lets out a wild, piercing scream and falls to the floor with a lump as big as a duck egg on the back of his cute little knob. The unlucky father sits in the chair, petrified, with the trusty steel hooks hanging limply on each side. The mother gathers the victim up in her arms and declares to high heaven that he is distorted beyond redemption. Such an unnatural father she never has seen. To hit a poor little defenseless creature a belt on the back of the head simply because he crept up on his knee!

"You take my tip ol' man," Bill remarked kindly, "and keep away from that cast iron thing. What's the next item on the program?"

I'll straighten out those thin, stooped shoulders—square them up—broaden them—literally pack muscle on them until they look like a piano mover's. Little lumps of red blooded muscle will magically appear, here, there, everywhere—and you'll feel so full of pep and vitality you'll want to conquer the world!

"How do you suppose he works this magical transformation?" I asked Bill.

"He hits the guy an upper cut on the chin," Bill replied airily. "I've seen lots of birds straightened up that way. A little more of the same treatment will raise the little lumps of red blooded muscle here, there and elsewhere, but I'm doubtful, extremely doubtful if the treatment will fill the party of the second part so full of pep and vitality that he'll want to conquer the world. My guess is that he will be filled with pains and aches and a murderous desire to wrap a baseball bat or a 6-foot stillson around the neck of the party of the first part.

"That reference to piano movers is a lot of hokum. I've seen lots of 'em. They don't carry the pianos on their backs like so many snails. The average molder lifts more weight in a day than a piano mover lifts in a week. How come? You ask. Well I'll tell you.

"Take a man who puts down 200 flasks, 12 x 18 inches, 4-inch cope and drag. One of these flasks contains 1728 cubic inches, a cubic foot of rammed sand and a cubic foot of rammed sand weighs 80 pounds. He lifts the sand twice, once in filling the flask and once in carrying the rammed mold from the bench or machine to the floor. That means he lifts 32,000 pounds of sand and approximately 2000 pounds of iron in pouring off, a total of 17 tons. Just to fill out the day he shifts his own weights, another couple of tons in the aggregate, and he may shake out the molds and cut over his sand. Put a piano mover in a foundry and he would curl up and die before the wind went on.

"If there is one thing more than another that makes me tired," Bill continued, "it is the careless and offhand manner in which superior beings

who never have done a day's labor, refer to members of the working class. The same objection also holds to the manner in which amateurs rush into print to describe the inside workings, methods and policies of manufacturing establishments.

"Additional evidence—if indeed additional or any kind of evidence is needed to prove the truth of the old and time tried saying that a little knowledge is a dangerous thing—appears in a skinny little pamphlet issued recently by a famous and widely known financial institution.

"Instead of confining itself exclusively to the financial field where its marked success over a period of many years attests to its comprehensive knowledge of how to juggle money to the best advantage, this company extends itself to conduct surveys of one kind or another. Sometimes it concentrates on one. Again it has several in the air at one time. These surveys ostensibly are for the well being and benefit, social, mental, moral, physical and financial of its myriad of faithful, but presumably slightly dumb subscribers. In a recent venture some of its promising young sleuths were instructed to peep into the foundry jungle and to conduct a number of judicious surveys of various kinds. The results of these various surveys have been compiled, edited, annotated, digested and translated and then issued in small pamphlet form to a select list of the company's clients engaged in the foundry industry.

"All quite free and without obligation of any kind to the recipient. Between you and me and the old hitching post I don't mind admitting that taking them singly or in mass formation, they are well worth the price.

"In accordance with a general policy which seems to prevail in high financial circles, the actual work of examining conditions and conducting these industrial surveys invariably is entrusted to young men who are not hampered or biased in any way by any previous knowledge or experience in or of the industrial field. They are clean and fresh, without guile of any kind. They hear and see as little or as much as the guide for the time being chooses to tell and show them. They approach one of these propositions with a free and open mind, which simply is only another way of saying they know nothing whatever about it. They leave it in practically the same condition. To slightly paraphrase a famous saying of the late Dr. Eliot 'They bring nothing with them and they take nothing away.'

"With this background, training and equipment they conduct a long distance survey and then present their valuable, serious conclusions and recommendations to practical and long experienced men who have spent the greater part of their lives wrestling, not only with the particular problem under discussion, but with forty other near relatives of whose existence the diligent young surveyors are totally unaware.

"One of these recent surveys deals with the burning question of deciding when a pattern is obsolete. How is a foundryman to determine when a pattern has outlived its usefulness? At what period of its existence should he cease furnishing shelter for it? Are there or are there not any standards in the foundry industry by which this problem can be settled? If not, why not? That's the idea. Smart and peppy. The note of authority, tempered slightly perhaps with just a tinge of condescension.

POPULAR SONGS: *I HEAR YOU CALLING ME!*

"From a neat, but comfortable office at headquarters containing all the necessary doodads and hickeys for conducting surveys on any subject, questionnaires were sent to a selected list of foundries to discover what disposition was made of all the patterns made and utilized in these places over a period of years.

"Strange to say, a wide diversity of practice and opinion was noted in the replies. Instead of the uniformity or near uniformity which the guileless surveyors apparently expected, a discouraging and chaotic condition was presented. Each foundry seemed to consider that its pattern problems were peculiar to itself and had adopted an arbitrary method in solving them.

"If the surveyors had stopped at this point, if they had been satisfied with a plain presentation of what presumably intelligent foundrymen are doing, if they had allowed the reader, also a presumably intelligent foundryman, to compare methods and draw his own conclusions, the report, while of doubtful value in proportion to its cost of compilation and distribution, still would not excite criticism or even a mild measure of ridicule.

However, the compilers did not stop at that point. With the zeal of the true reformers, whose zeal usually is in inverse ratio to their knowledge of the subject or cause they champion, they continually harp on the obligation the foundryman is under to supply castings indefinitely from a given pattern.

"The inference is conveyed that every customer has a property right in every pattern, a right which the foundryman must respect world without end, amen.

"This may be true where the customer supplies the pattern, but where that condition obtains, the customer and not the foundryman has the privilege and pleasure of deciding whether any given pattern should or should not be destroyed, or retired from circulation in any other manner. Where the foundryman openly or tacitly contracts to supply a casting or a number of castings at a definite figure and then makes his own pattern, that pattern is as much his property as the drawings, the sand, the tools, the flasks or any other part of his regular foundry equipment.

"He can destroy it or keep it without any by-your-leave or without consulting any person or anything outside his own experience. It's his. He is under no more obligation to keep a pattern from which a customer once ordered a casting, than a tailor is under obligation to keep a roll of cloth to repair the ravages of wear and age in a customer's suit.

"Certainly he is in a better position to determine this point locally and with a full knowledge of all conditions, than is any body of amateurs whose only knowledge of and contact with the foundry and its patterns has been secured through a few brief reports on a single phase of the subject."

Study Soil Corrosion

Two field investigations of corrosion of pipe lines have resulted in valuable data on the processes of corrosion of steel and cast iron pipe lines, according to the bureau of standards. Special tests of soil conditions have been started in 18 locations. The Cast Iron Pipe Research association has appointed a research associate to assist the bureau in the study of cast iron pipe.

Die Casting Machines Make Variety of Parts

Large Eastern Company Produces Large Tonnage of Castings Annually in a Well Planned Plant. Maintains Complete Machine Shop for Making the Necessary Dies

By Herbert R. Simonds

PERHAPS in no other product in the world has the urge to reduce labor cost been so strong as in the case of the automobile. Each part entering into the production of the modern automobile has been analyzed and reanalyzed to determine the method of producing it at the lowest possible cost, until today each part for its purpose is an example of the survival of the fittest. Forgings, stampings and castings in addition to rolled steel forms joined by welding and die castings all have their proper functions to fulfill. The latter items are comparatively recent developments; they were unknown at the time the first automobile was operated. From 30 to 40 parts on a typical automobile today are made of die castings. A few of these are the motometer frames, the carburetor parts, ignition and lighting system parts, magneto housings, and steering wheel supports. In the manufacture of sewing machines, cash registers, pianos, motion picture machines and other products die castings are widely employed and the industry is expanding rapidly. This development is well illustrated in the history of the Newton Die Casting Co., which moved into a new plant at New Haven, Conn., some time ago. To a large extent the history of this company centers around the activities of William G. Newton whose vision and tireless energy have contributed much to the die casting art. After eight years of experience, in various phases of die cast-

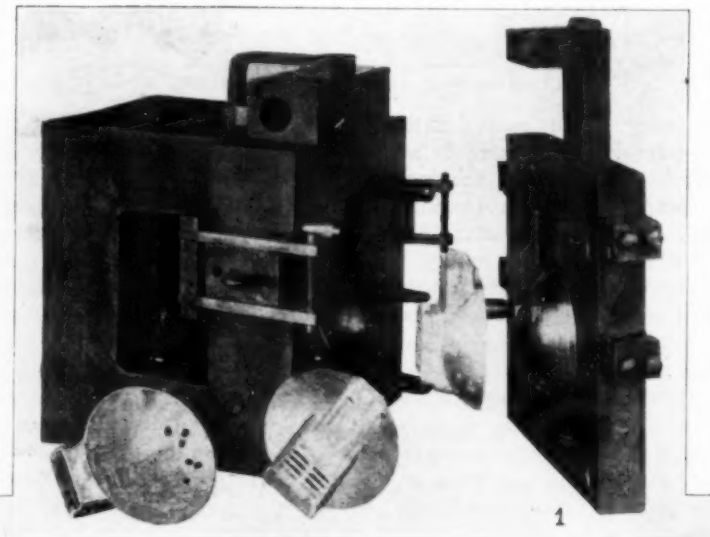


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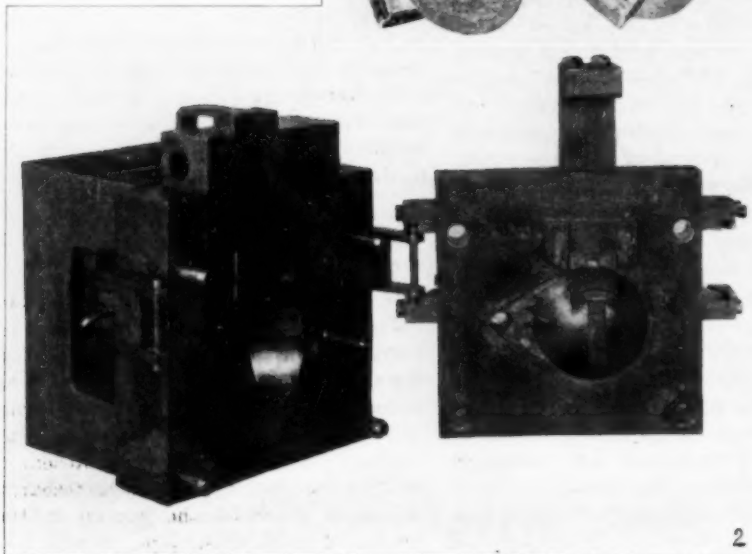
Fig. 1—Right—Dies for Making Die Castings Usually Are Made from Solid Steel Blocks. Fig. 2—Below—Method of Gating is Shown in this Wide Open Die

Fig. 3—Below—Same Set of Dies Shown in Figs. 1 and 2. The Gate Is Shown at the Right. This Die Produces an Aluminum Part for a Miner's Lantern



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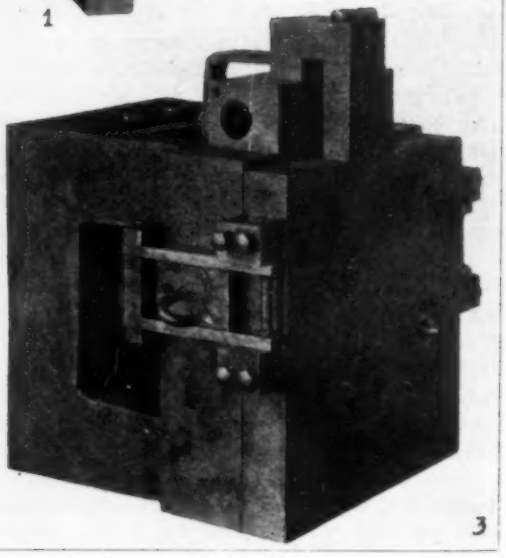

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Fig. 4—Portion of Finishing Department Where Castings Are Sorted, Inspected, Cleaned and Placed in Containers Ready for the Shipping Department

ing, Mr. Newton took over the management of the Marf Machine & Die Casting Co., Brooklyn, N. Y., and in a period of less than five years increased this company's production by more than 600 per cent. Toward the end of last year, he was instrumental in bringing about a merger of the Marf Machine & Die Casting Co. and the die casting division of the National Lead Co., both of which companies operated plants in Brooklyn, N. Y. The new company, known as the Newton Die Casting Corp., recently closed both of these plants and transferred all manufacturing activities to a 6-story concrete building at New Haven, Conn.

This new plant is the first die casting plant to operate in New England and, as it is the newest die casting plant in the country, and the only one to be completely planned as a unit upon experience through gradual development elsewhere, much interest attaches to its operation.

The building now occupied was erected during the war for the manufacture of light munitions but it has proved singularly well adapted to die casting requirements. The building extends for 500 feet along the siding of the New York, New Haven & Hartford railroad. At one end there is a spacious shipping platform where the various products of the plant are assembled for loading into freight cars for shipment to all parts of the country.

At the opposite end is the unloading platform where the raw materials enter the plant. Raw materials for a die casting plant consist chiefly of pig aluminum, zinc, lead, tin and other metals, steels of various grades for use in construction of dies and cores, and tools for the machine shop. Of course, many other materials enter any plant with such varied activities as those of a large die casting establishment. Boards, barrels and packing cases are required in large quantities for shipping the plant products and large quantities of water, oil and gas

Fig. 5—Aluminum Die Casting Department Occupies the Entire Top Floor of the Building with Rows of Die-Casting Machines Extending Down Both Sides

are constantly being consumed. The city gas consumption at the Newton plant reaches the surprising figure of $60,000 a year.

The flow of material through the plant has been well planned. The incoming material is received and stored on the ground floor. At the far end of this floor is the metal mixing department. Here a bank of gas-fired tilting crucible-type furnaces convert the pig metals and the sprue from the plant into alloys suitable for die casting. The alloys in the shape of pigs are carried by elevators to the upper floors of the building where they are distributed to the various machines by electric lift trucks. The top floor is the aluminum casting department.

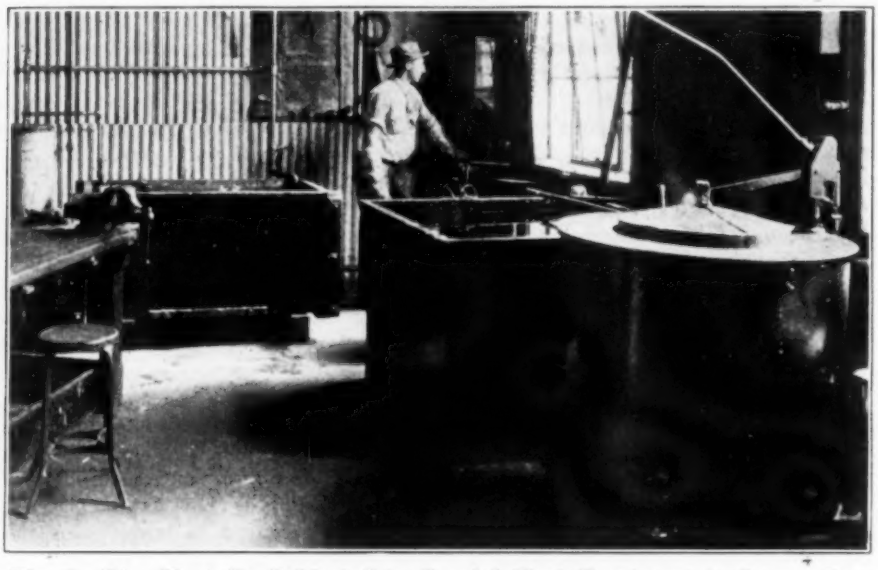


Fig. 6—Dies Must Be Subjected to Careful Heat Treatment to Insure Long Life Under the Use to Which They Are Put

Here on two sides of a long well-lighted room are the rows of aluminum casting machines. These are specially designed and specially built machines. The principle, however, is similar to that for any aluminum die casting process. The alloy is melted in a large reservoir at one end of the machine, (the window end in this plant). The main frame of the machine carries the die with the elaborate mechanism for the placing and withdrawing of the various cores, for the closing and opening of the die, and for the ejection of the casting after it has been made.

Having once designed and built a die and its auxiliary mechanism and adjusted this to a die casting machine, the sequence of operations is relatively simple. The open die, mounted on a movable die carriage, is cleaned out with a handy jet of compressed air. The parts then are closed and the cores moved in place. This placing of cores is frequently an automatic process controlled by the opening and closing of the die parts or by the movements of the complete carriage up to the nozzle of the metal reservoir. When the closed die with cores set has been clamped against the nozzle, then in the phraseology of the shop, it is given a shot. This means that the air pressure is turned on forcing the molten metal through the gate of the die until the die itself is completely filled. For aluminum, the temperature of the molten bath is about 1250 degrees Fahr. The air pressure used ranges from 450 to 500 pounds per square inch. The liquid metal fills all of the cracks and spaces in the die and surrounds the steel cores. After the air pressure has been sustained for an appreciable interval, the pressure is turned off and the die withdrawn from the nozzle.

Part of the science of die casting is the time element between filling a die and ejecting the cooled casting. It is important that the casting be cooled just enough but not too much. In order to speed up the cooling of the casting and also to keep the die steel cool, circulating water is run through all of the heavy sections of the dies. A typical die opened to show its construction, is illustrated in Fig. 1. The casting, which in this case is a lamp reflector part, is shown in the position it would occupy just after being ejected. The water circulating opening may be seen on top of the left hand part. Fig. 2 gives another view of this same die, showing the method of gating and Fig. 3 shows the die closed ready for the metal. The gate may be seen at the right.

The floor below the aluminum department is the zinc, lead and other soft alloys casting department. This has two long rows of casting machines similar to those on the top floor. However, there are differences in the design of the machines themselves due to the lower temperature employed. Zinc alloys are held from 800 to 850 degrees Fahr. in the reservoirs.

On the third floor from the top is the diemaking machine shop. This, as may be imagined, is a large department equipped with modern machine tools. An important feature of this department is the heat-treating room. This room is equipped with thermostat controlled, gas and electric furnaces with oil circulating quench tanks and other equipment called for in modern heat treating plants.

Dies, in a die casting plant, take the place of molds in a foundry, yet in one sense they more logically correspond to the pattern. They are made up for each individual job and then are stored in a die storage room until again called for. The average cost of dies for one casting is about $500. Some, of course, cost between $2000 and $3000 each.

Although dies are considered a necessary evil in the die casting business, they are paid for to a large extent by the consumer and, in this respect, the die casting plant has an advantage over the sand casting foundry because the practice of having the customer pay for the pattern in a foundry is not well established in the industry.

The proper storage and handling of dies in die casting plants, however, is an item of no small expense. As the shop grows, the filing system becomes more elaborate. A safe place must be provided for their storage and insurance must be carried. In order to keep the stock down to as low a point as possible, the Newton Die Casting Corp. has a scheme of discarding old dies. Dies, which have been in storage three years without being used, are called obsolete and their cards automatically come up for attention. A letter is then written to the customer pointing out that the die has now been placed on the obsolete list and that it will be destroyed unless advice to the contrary is received. After this notice has been sent out, and in case no reply is received, the die in question is taken from the storage and put in a suspense or obsolete storage pile where it is allowed to remain for about a year before being destroyed. The main die storage room at the Newton plant is estimated to contain dies valued at $3,000,000 or more.

In addition to the dies used for castings, it frequently occurs that other dies are called for in the finishing or cleaning operations. These

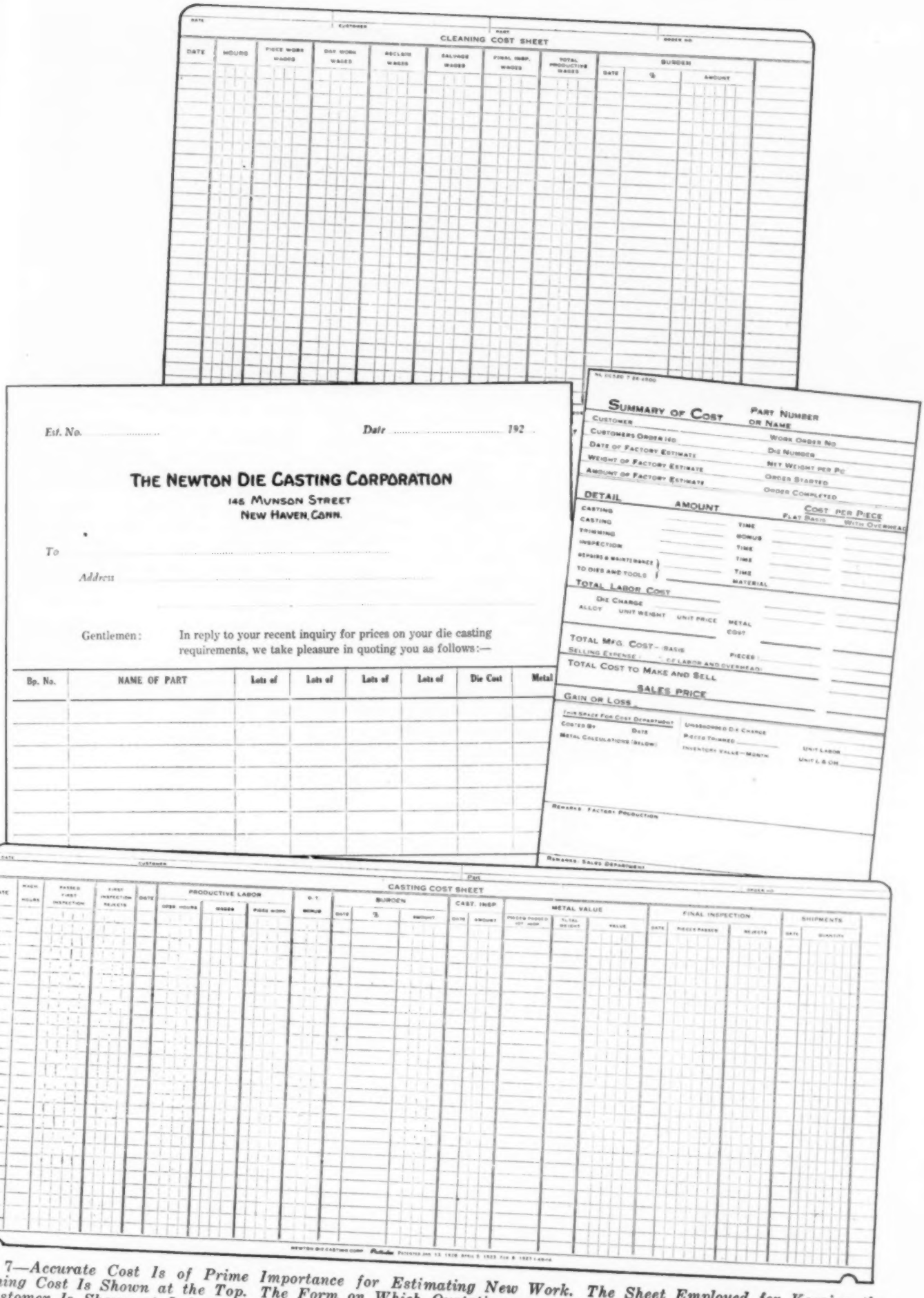


Fig. 7—Accurate Cost Is of Prime Importance for Estimating New Work. The Sheet Employed for Keeping the Cleaning Cost Is Shown at the Top. The Form on Which Quotations on a Die Casting Requirement Are Forwarded a Customer Is Shown at Left Center. A Summary of the Cost of a Job Is Recorded on the Form Shown at Right Center. The Form Employed for Recording the Cost of Casting Metal Is Shown at the Bottom

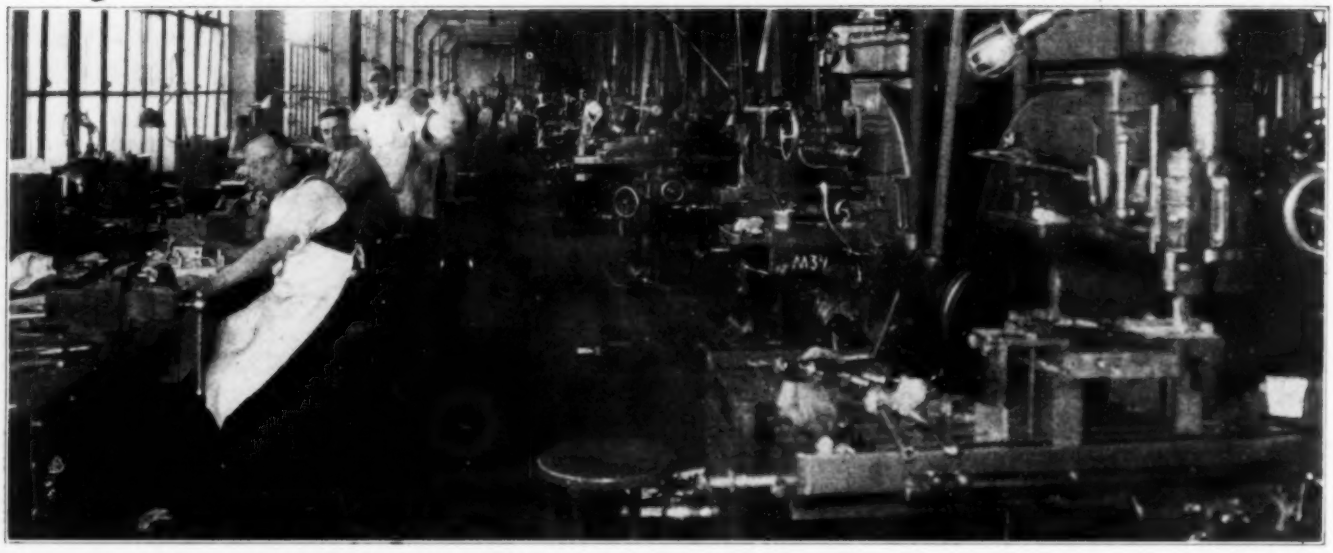


Fig. 8—Partial View of the Machine Shop Which Is Required for the Precision Work in the Construction of Steel Dies

while less complicated also call for accurate work and are made in the general machine shop. They are used mostly for trimming the fins which sometime occur at the joint between die parts.

Two floors constitute what is called the cleaning department. In reality the castings here go through many finishing operations including some light machine work, and some assembling. The plant is operated chiefly as a jobbing shop and makes parts rather than complete articles. There are a few exceptions to this practice and the company has recently started a manufacturing department in which certain articles are turned out for direct sales.

Other parts of the large plant are occupied with the toolroom, the packing and shipping department, the steel storage room where alloy steels for diemaking are stored, and the power plant. Special attention has been given to this latter department. The whole operation of a die casting plant is dependent upon an adequate source of high-pressure air. A failure in the air supply and the plant instantly becomes idle. Therefore, to guard against such danger duplicate compressor equipment has been installed. Some idea of the piping necessary in a modern die casting plant may be secured from a brief description of one of the die casting machines.

Fig. 5 shows a portion of the aluminum die casting room. From this an idea of the arrangement and the long rows of die casting machines may be had. The machine in the foreground clearly shows the die carriage and the hydraulic plunger which operates it. The pot containing the liquid aluminum alloy is at the window and, just behind the sheet iron partition. The pots vary in design, but the usual type for aluminum work at the Newton plant is a tilting pot, that is, the metal chamber tilts. In most cases, it is a smaller chamber inside of the main pot which tilts or raises to fasten against the die gate opening. Because the metal chills rapidly when it comes in contact with the die, it is important to apply sufficient pressure to the metal before it enters the die.

Speed Is Essential

The finish of the casting is largely dependent on the speed of this operation. To insure this speed, air pressure, as has been stated, at nearly 500 pounds per square inch is used. A typical machine must be piped for this high-pressure air and for the high-pressure water for closing the die, and for adjusting the core and moving the whole unit up against the metal spout. It also must be piped for low-pressure water for cooling the die, must be wired for electricity and piped for gas, for light and for a fan for fresh air for the operator. Then there is the gas supply and in addition a low-pressure air system for cleaning out the dies after the casting has been ejected. Thus, there are five independent piping systems connected with each die casting machine and one electric conduit. The power plant is the central point where all there various systems originate. Fig. 6 shows a corner of the heat-treating department. It will be noted that there is an overhead trolley rail for transporting material to be treated to the various furnaces and quenching tanks.

The extent of the tool room is clearly indicated in Fig. 8. A large part of die work is bench work, and for this reason a bench extends the full length of the building directly in front of the large windows. This department might well be regarded as an independent manufacturer. Its complete product is the highly specialized casting die. The life of the whole organization centers around the die. Dies of poor construction, faulty material or improper design will quickly use up all the profit in a fairly sizable job. For this reason the dies are built for endurance with little regard to expense. For quantity production the best possible die is the cheapest in the end.

Some time ago, a large manufacturer who was making his own die castings on a rather small scale was having difficulty and asked an official of the Newton company to explain why his castings were cracking. He was told his difficulty might be:

1. Hole in insert fitting too snugly on core so that when core is withdrawn strain is put on casting.
2. Hole in insert too large allowing metal to flow between insert and core. This small flash of metal possibly accumulating and causing next insert to fit too tightly.
3. Outside diameter of insert fitting too snugly in sleeve core causing strain when core is withdrawn.
4. Outside diameter too small permitting metal to flow between insert and sleeve core. This metal possibly accumulating and causing next insert to fit too snugly.
5. Inside diameter and outside diameter of insert not concentric.
6. Metal temperature not correct.
7. Die temperature not correct.
8. Casting production not at proper speed possibly permitting casting to remain too long in die before ejecting.
9. Die not lined properly.
10. Machine not lined properly.
11. Possibly wear in dowl pins permitting upper half of die to drop slightly when being opened.
12. Bent core pin in insert.
13. Undercut in die caused through

closing die on chips or flashes of metal from previous shots.

14. Wear in ejector guides causing casting to be ejected unevenly.

15. Upset end of cores.

Wherever possible the dies are cut from solid blocks of steel. This is often more expensive than building a die of two or more parts, but it avoids much difficulty. Molten metal under pressure has a way of getting into the smallest cracks and a die made of several parts may start the day with a perfect fit which cannot be detected, and may end the day with a crack large enough to cause objectionable fins on the casting. Dies are heat treated carefully to relieve internal strain and protect the surfaces from the action of the molten metal. During the life of the die for zinc and lead alloy work 500,000 castings frequently are made.

Even though the production of accurate castings is of first importance in the die casting business, there are other important features. One of these is cost accounting. The die caster is faced with the same difficulty in estimating cost of new work that confronts the sand foundryman.

In securing a new piece of work, the procedure is somewhat as follows. The first thing to determine is whether the job falls properly in the field of die casting. First, comes the question of weight. A large piece arbitrarily is discarded as a possibility, because the die casting art as at present developed has definite limits as to size. Approximately 12 pounds is the maximum weight to be considered. Of course, the die casting salesman does not immediately turn his back on an overweight job. He first considers whether the weight can be reduced to come within the die casting limits. If not, he determines whether the commodity can be made efficiently in two parts, each of which might be a die casting. The next consideration is the number of pieces required. If the number is low, economic considerations immediately throw this job out of the die casting field. For one thing, a die cost ranging from $500 to $1000 will be incurred before the first casting is made.

The next consideration has to do with strength and material. Die castings at present are made only of metals or metal alloys having certain definite properties. In general, die castings are limited to zinc alloys, tin alloys, lead alloys and aluminum alloys.

Having determined that a certain product is of the right weight, that it is to be made in sufficient quantity and that it may be properly made of one of the usual alloys, the next question is to determine the design of the die. Experience and ingenuity combine to make it possible to build a die for almost any conceivable shape of casting. However, when the casting itself has too many undercuts and complicated cavities the construction of a die may be impractical, either because of its original cost or of the cost in production of the work. However, if the design seems to indicate that a suitable die may be readily constructed, the next step is to make up an estimate of cost from which a quotation to the customer may be made. Before the quotation is sent, the estimate is checked carefully against previously completed jobs of a similar character. The quotation is sent out on the form shown in Fig. 7. Several other forms used in the cost system of the Newton Die Casting Corp. also are shown in Fig. 7.

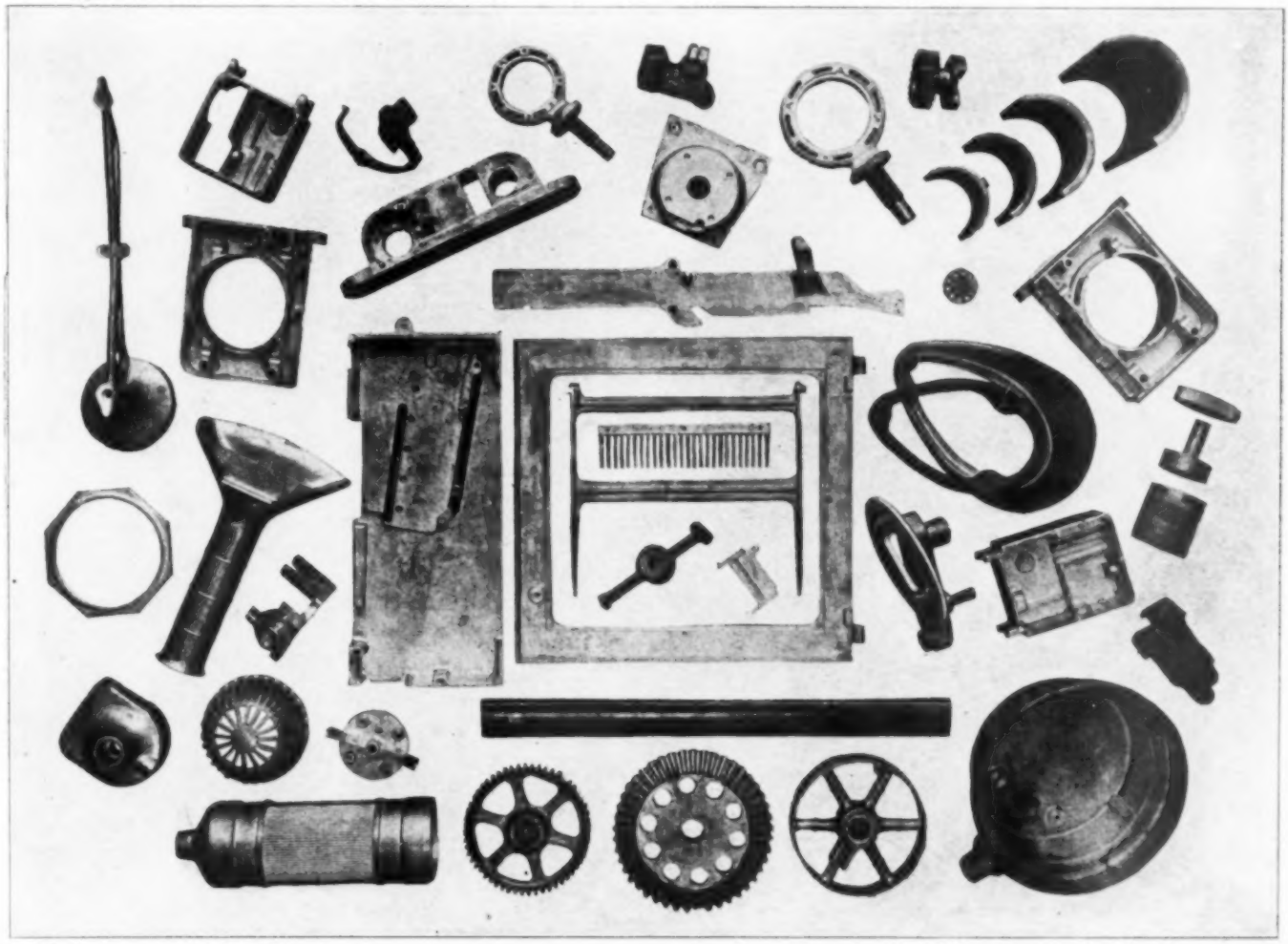
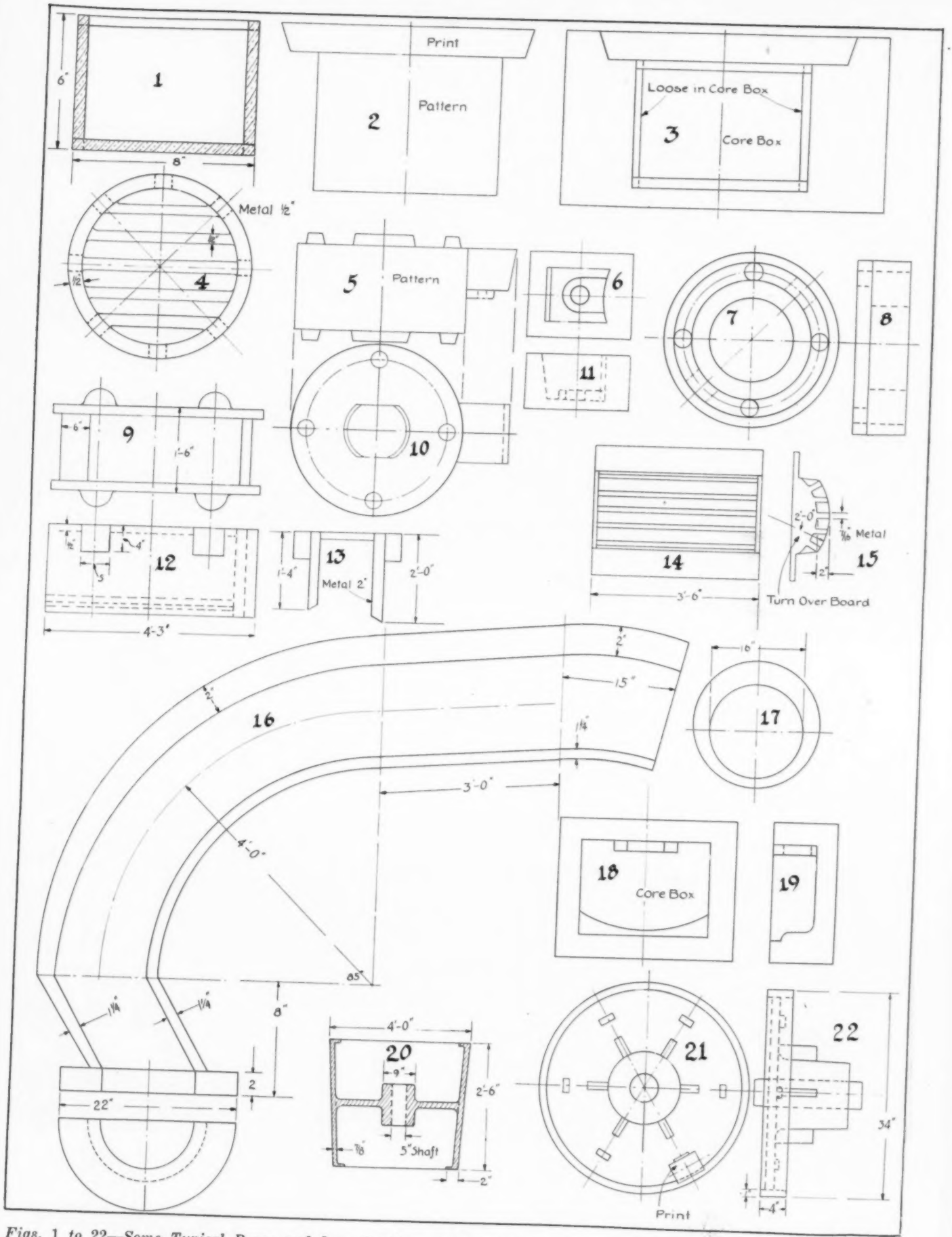


Fig. 9—A Few of the Commodities Made in Die Casting Machines Which Depict the Varied Character of this Industry



Figs. 1 to 22—Some Typical Brass and Iron Castings, with Their Respective Patterns and Coreboxes Used in the Paper Mills. Reading from Left to Right and Down the Illustrations Show a Strainer Basket, a Water-Cooled Bearing, a Pocket, a Second Type of Strainer, a Sulphite Pipe, a Taper Pulley and a Clutch

Paper Mills Demand

Great Variety of Castings

By P. D. Forbes

Fig. 23—Dryer Shell 12 Feet in Diameter

ALTHOUGH the public constantly uses paper in a variety of forms, the average person knows or hears little of the paper-making industry. General uses of paper continually are expanding. Paper bags for wheat, flour, cement, etc., recently have been adopted. Many articles for household use, no doubt eventually will be made of paper. Mention also might be made of the rayon branch of the paper and pulp industry. Today the per capita consumption of paper is 200 pounds per year, with 50 pounds in the form of newsprint alone.

The paper industry, reckoned seventh in importance among the great basic industries of the country, is no small user of foundry products. Many leading paper mills located in out-of-the-way regions, at considerable distances from points where spare parts can be obtained, maintain their own foundries. At the British Columbia plant of Pacific Mills, on the Skeena river, 250 miles north of Vancouver, a modern pattern shop and foundry are operated, one of the most northern foundries on the entire American continent. A modern pattern shop and foundry also are operated at Corner Brook, Newfoundland, in connection with one of the plants of the International Paper Co.

Demand for more paper constantly is increasing. Output of newsprint alone in the United States and Canada, is 4,000,000 tons per year, with an approximate value of $250,000,000. Everything seems to indicate that in coming years the paper industry fully will maintain its position as one of the principal users of foundry products.

A modern paper mill contains about 10,000 tons of iron, steel, brass and lead castings. Some, like the dryer shell shown in Fig. 23 are quite large

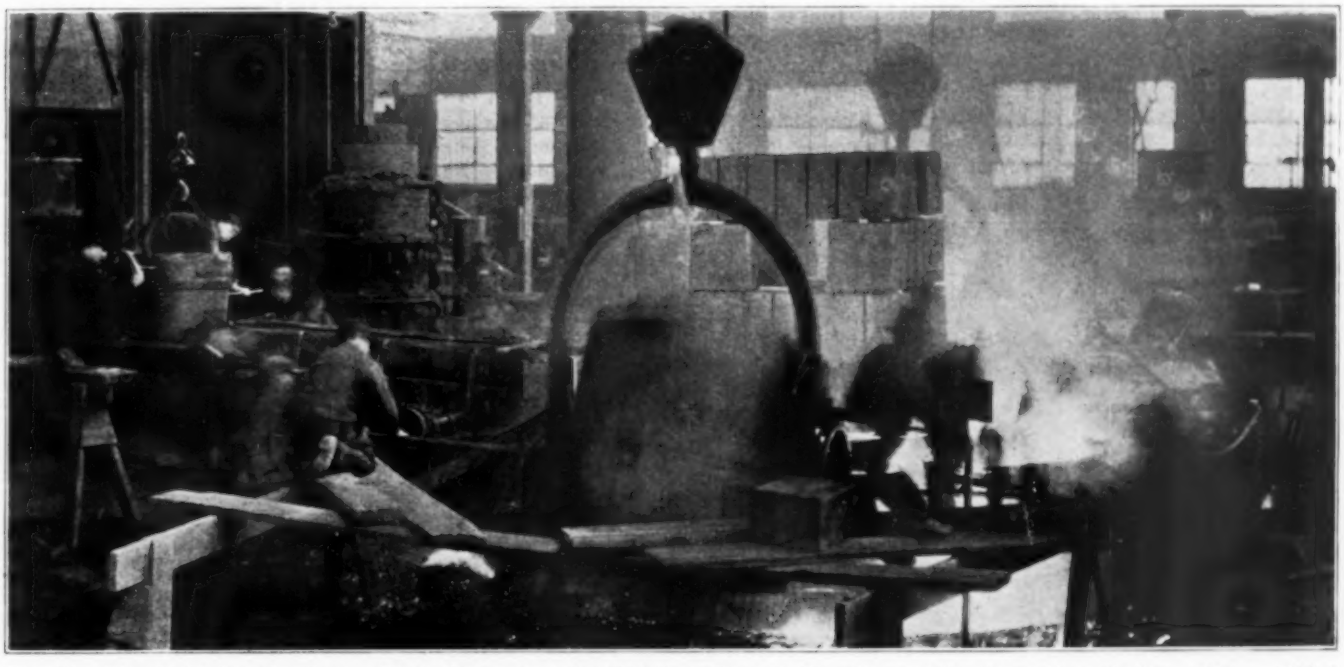


Fig. 24—The Mold for the Dryer Shell Shown in Fig. 23 Was Poured Simultaneously from Two Ladles with a Third Held in Reserve as Shown to the Left. The Mold Was Made in Loam and Assembled in a Pit

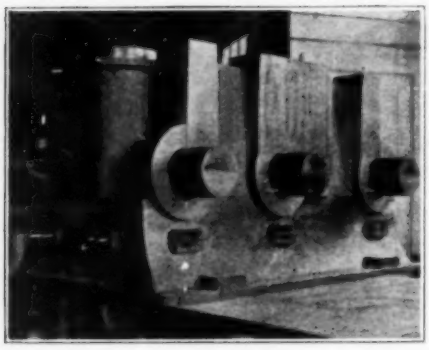


Fig. 25—The Base Left Its Own Green Sand Core

and heavy, while a vast number of small castings of every conceivable shape and form also are used.

According to a recent estimate fully 6000 foundry, machine shop and allied craftsmen are constantly employed making machinery for the paper industry in North America alone.

A modern papermaking machine, mostly cast iron, weighs approximately 2000 tons. Many of the castings are plain frames, posts, brackets, etc., but quite a few are of a complicated type. Fig. 23 shows a dryer for a Yankee paper machine, made by Pusey & Jones Corp., Wilmington, Del., 12 feet in diameter, with a finished face of 11 feet and a total weight of 66,750 pounds. Dryer shells are the heaviest castings on the machine. The usual size is 5 feet in diameter with the wall finished to 1½ inches thick. If journals are cast on they add about 2 feet 6 inches to each end and are finished to about 10 inches diameter. Approximate weight of one of these 25-foot castings is 20 tons. Fifty castings are required on a modern machine.

Usually the dryer ends and journals are cast separate and afterward bolted to the shell. With this form of construction the inside of the shell may be machined, a feature usually specified on all high-class machines.

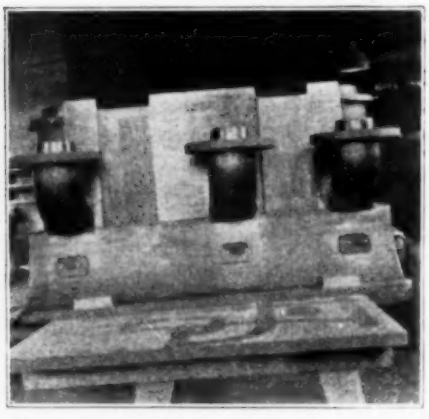


Fig. 26—With the Exception of the Elbows the Upper Part of the Pattern Was Nearly All Core Prints

An idea of the immense volume of water pumped in a paper mill may be had from the statement that 200 tons of water are required per ton of paper produced, and mills are in existence today making 700 tons of paper per 24 hours. In terms of gallons, one of these mills needs pumps with a combined capacity of approximately 400,000,000 gallons per 24 hours. Types of pumps vary from those a few pounds in weight up to those with a total weight of 12 to 15 tons. Figs. 25, 26, 27, 28 and 29 show five views of a pattern and coreboxes for a somewhat complicated casting used for pumping operations in a paper mill. It is a combined pump base and pump chambers all cast in one piece for a triplex pump with a total weight of about 6 tons.

Study of the illustrations will indicate this is a job requiring a number

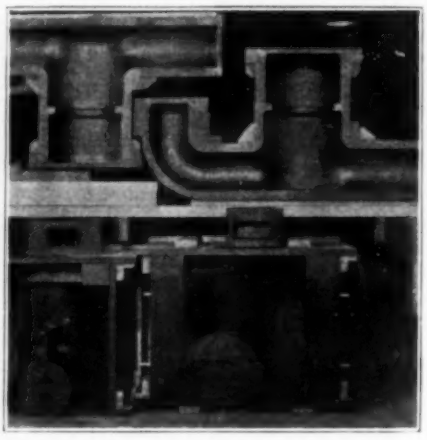


Fig. 27—Part of the Set of Coreboxes for the Pump

of carefully made coreboxes to insure best results. Figs. 25, 26 and 28 show the completed pattern ready for the foundry. The pattern was parted along a line at the top of the base. The elbow pieces were left loose. The bottom part left its own core. The remainder of the mold was formed with a set of right and left-hand cores. Figs. 27 and 29 show the completed coreboxes.

A common type of bronze pipe weighing about 750 pounds used in sulphite operation in a paper mill is shown in Fig. 16. If this casting was required in large quantities, a solid pattern and complete right and left-hand coreboxes probably would be made, but as only a comparatively few castings are required, the usual procedure is to make a skeleton pattern and skeleton core frames, one right and one left, or one-half of a corebox, with a snap for the other half.

In the modern paper mill representing an average investment of $10,000,-

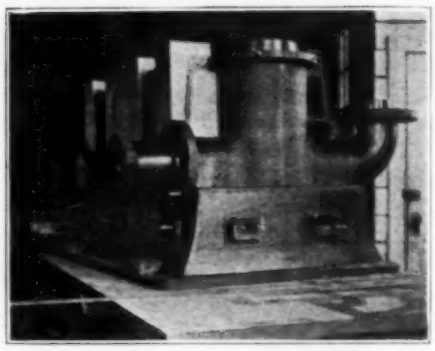


Fig. 28—Rectangular Core Prints Were Pinned to the Sides

000, including all the various manufacturing units, the three castings referred to represent typical examples of heavy castings required. A large variety of castings in the various units of the plant range in weight from a pound or two up to 20 tons.

A few months ago the American Manganese Steel Co., Chicago, made a number of castings for the Manitowoc Engineering Works, Manitowoc, Wis., which are claimed to be the largest one-piece manganese castings ever made. These castings were for a Wisconsin paper mill.

Fig. 5 shows the pattern for a water cooled bearing, a plain cylinder, built up in segments, with cope and drag prints for the main core and the core for the water chamber. A print also is mounted on the pattern to form the hook piece. The bottom half of the hook leaves its own core. The other half is formed in the corebox shown.

The water-jacket corebox is shown in Figs. 7 and 8. A cleat carries the hubs in the water chamber core. This core is made in halves and pasted. Figs. 1 and 4 show a strainer basket required in considerable quantities. The method of molding is illustrated in Figs. 2 and 3, which show pattern and corebox. These baskets are made in a great variety of sizes.

Fig. 20 shows a type of taper pulley

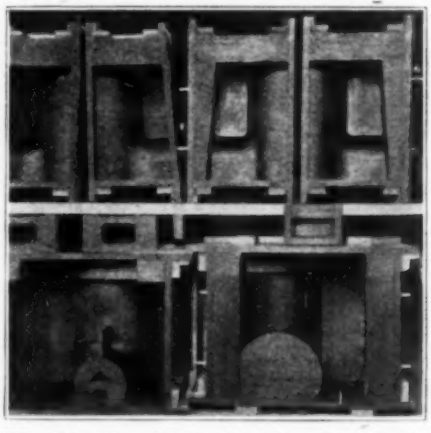


Fig. 29—Coreboxes for Forming Parts of the Exterior

largely used in paper mill operations. These pulleys are made in sizes varying from 12 inches diameter, and 12 inches face to 60 or 70 inches diameter, 30 inches face, and ranging in weight from about 100 to 2000 pounds. Where a number of the same size are required, the usual method is to make an iron ring pattern either from a wood pattern built up in the usual manner or swept up with proper machining allowance. Arms and ribs on rim, are made separately and are bedded in. Variations in rim thickness may be secured by the use of lagging strips applied either inside or outside the iron pattern ring. Sand between and above the arms is lifted on a crab. Usually these pulleys are provided with lugs on the hub and rim so they can be split in halves by suitable thin cores.

Figs. 21 and 22 show a hub for a clutch used in connection with these pulleys. To insure the correct location of the rectangular hubs a corebox usually accompanies the pattern with one-half of the hub on a print as shown. By allowing the print to extend well out toward the outside of the pattern, the corner on the flange of the clutch can be taken care of nicely as shown in the illustration of the corebox, Figs. 18 and 19.

A pocket for a wood pulp grinder is shown in Figs. 9, 12 and 13. A grindstone about 50 inches diameter and 50 inches face is rotated either by a water turbine or an electric motor. The stone is enclosed in a cast iron casing. The operator introduces the wood to the stone through the pocket casting shown. This casting is molded in green sand and leaves its own core. Another style requires a dry sand core made in halves and pasted together.

After the wood is ground to pulp and diluted with water, the stock, as it is now called, passes through a series of centrifugal screens. Figs. 14 and 15 show the circular frame of one of these brass screens attached to a circular copper plate, perforated with holes 1/32-inch diameter, and with 50 holes to the square inch.

Fig. 15 shows the turn over board, usually used in making molds for castings of this kind. Brass and bronze bearings in a wide range of styles are used in a variety of places in the paper mill. Large water-cooled iron bearing shells, some split, others whole, also are employed extensively.

These bearings in service carry a brass half bushing and the cored space must admit the bushing without any machine work. The corebox shown in Fig. 7 allows the bushing to slide easily into place with fully 1/32-inch clearance all around. The pattern is exactly similar to the casting, except for the cope and drag prints. Figs. 1 and 4 show a cage-like casting required in considerable quantities. Figs. 2 and 3 show the pattern and corebox required. These castings are made in a wide variety of shapes and sizes.

The corebox conforms to the outside shape of casting. Loose pieces with spaces cut in them the required thickness are placed in the corebox.

Pipe Concludes Century of Service

The history of the Philadelphia water department dates back to 1797 when a proposal was made to join the Delaware and Schuylkill rivers by a canal, according to a publication of the U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J. The object of this project was to supply the city with water for watering, cleaning the streets, and extinguishing fires and also to form a source of supply for pipes and conduit. However, this proposition was abandoned.

The Schuylkill river and Spring Mills then were considered as possible sources of supply and in 1798, B. Henry Latrobe examined and made estimates on the two propositions and decided in favor of the Schuylkill river.

In 1799 work was started under the direction of Mr. Latrobe and in 1801 water was supplied to 63 houses, 4 breweries and a sugar refinery. The water was taken from the river and pumped into a cistern on the bank and from there, a gravity line carried the water to a well. The Central Square pumping station was erected nearby and the water was elevated from the well to tanks situated over the station.

Bored, white oak logs were used both for supply and distribution. These logs cost 8 to 12½ cents per linear foot and apparently did not give satisfactory service for Mr. Latrobe in a letter dated, Dec. 5, 1801, said: "Wooden pipes are a source of perpetual expense, repair and interruption."

Evidently the city officials realized the importance of Mr. Latrobe's statement for the same year, 14 pieces of cast iron pipe, 6 feet long, were laid at the Central Square engine house to determine the best method of securing joints under the greatest pressure.

Further reports do not mention cast iron pipe for several years, but the problem evidently was being given consideration for in 1817 four hundred feet of cast iron pipe was bought in England and laid the same year. This must have proved satisfactory for in 1818 it was decided to lay only that kind of pipe in the future.

Recently, Philadelphia finished the construction of the new South Broad street subway. This enterprise necessitated the relocation of many of the underground pipe lines encountered in excavation. Among those removed was a 21-inch pipe line which official records at the Philadelphia water department indicate was laid in 1819. This line has been in continuous service from the time it was laid until its removal. One pipe is shown in the accompanying illustration after having completed over a century of continuous service and appears to be in good condition.

Fowler & Wolf Mfg. Co., has moved its offices from Pittsburgh to its factory at Oak and Corson streets, Norristown, Pa.

THIS PIECE OF PIPE WAS LAID IN 1819 AND WAS IN CONTINUOUS SERVICE UNTIL ITS RECENT REMOVAL

Continuous Ovens
Increase Capacity and
Speed Production

By Edwin Bremer

FOR many years cores were made in core boxes by hand, but as the demand increased improved methods were evolved. This does not mean that the newer methods have displaced the older altogether, because in a great many foundries, cores still are produced by hand. Present reference rather is applied to large production foundries where hand methods would be unable to supply the large quantity of cores needed each day.

In these foundries different machines for making cores will be found, including types similar to those used for mold making, the blower machine operated by compressed air, and the extrusion or so-called sausage type machine. Contrary to the one time rule of thumb practice the time and temperature of ovens are controlled to obtain uniform product. Also, in several of these foundries, continuous ovens have replaced the stationary type.

The latest features of core production are to be found in the Bond plant of the American Radiator Co., Buffalo. All cores are produced on machines, the small cores on small, hand-jolt, vibrating, rollover machines, and the larger cores on large, jolt, rollover machines. Although 33 stationary ovens are employed, the majority of the cores are baked in 3 large continuous ovens, fired by oil and gas, and equipped with automatic temperature control.

The core sand is mixed in two steel vessels similar to concrete mixers each of which has a capacity of about a cubic yard of sand. The core mixture

Conclude Series

IN this fourth and concluding instalment of the series describing the Bond plant, American Radiator Co., Buffalo, details are presented on the method of making, baking and handling large cores for boiler construction. The first of the series entitled, "Mechanized Operations Feature Largest Boiler Foundry" appeared in the Sept. 15 *issue. The second instalment, "Conserve Man Power by Eliminating Steps" was published in the Oct.* 1 *issue, and the third, "Heavy Boiler Sections are Made on a Production Basis" appeared in the Nov.* 1 *issue of* THE FOUNDRY.

Fig. 26—Above—A Completely Equipped Pattern Shop Makes the Master Wood Patterns from Which the Working Patterns of Iron Are Made
Fig. 27—Below—Cores for Boiler Section Are Produced on Jolt Rollover Molding Machines, and Baked in Continuous Ovens

is composed of lake sand bonded with a mixture of linseed oil, rosin and crude oil. The sand is placed in a large storage hopper inside the building and is admitted to the mixer by a downspout. Then the oil binder is sprayed in while the mixer is rotating. After a sufficient period has elapsed to allow the oil to coat the sand grains, a small quantity of water is added to give a better green bond strength. The mixed sand then is dumped into the boot of an elevator which raises the sand to the distributing gallery which may be seen in Fig. 29. The sand is dumped into small cars which then are pushed to the storage hoppers over the core machines.

Fig. 29—Core Sand Is Mixed in Large Double Cone, Rotating Drums, and then Is Elevated to A Distributing Platform Above

Fig. 28 shows the method of making small cores on a number of hand jolt, vibrating, roller over machines supplied by the International Molding Machine Co., Chicago. These machines are fitted with gang coreboxes and it is stated that only a fourth of the number of men are needed to equal the former production when the cores were made by the old method using split coreboxes. The small cores are turned out on flat steel plates which are placed on the roller conveyor shown in the background of Fig. 28.

This conveyor leads to the entrance of a small continuous oven 7 feet 8 inches wide, 19 feet high and 53 feet long which may be seen at the left of the illustration. The cores are placed on trays attached to an endless chain which makes four passes over the burners during its journey through the oven. To allow for expansion and contraction the long chain is passed over a floating sprocket free to move in a vertical direction and automatically adjusted to maintain the correct tension on the chain at all times. The oven is fired by an oil burner supplied by the Drying Systems Inc., New York.

Temperature in the oven is controlled automatically by a device supplied by the Leeds & Northrup Co., Philadelphia. This apparatus also includes a continuous recorder which shows the temperature at any period during the life of the chart. The approximate time for baking the small cores is 45 miuutes. Cores with a heavier section are allowed to pass through the oven a second time which makes the elapsed time 1½ hours. When the cores have been baked sufficiently, the plates and cores are re-

Fig. 28—Small Cores for Castings Are Made on Hand Jolt Molding Machines Containing Multiple Core Boxes

Fig. 30.—Boiler Parts Are Crated on a Conveyor System

moved to a roller conveyor on the far side of the oven. The cores are allowed to cool and then are taken to the various molding units where needed.

Large cores are made on jolt roll-over machines supplied by the Herman Pneumatic Machine Co., Pittsburgh; the Tabor Mfg. Co., Philadelphia, and the Milwaukee Foundry Equipment Co., Milwaukee. Views of the core-making units are shown in Figs. 27 and 31. As may be noted in Fig. 27, the core plates travel away from the oven on roller conveyors. Only a short section of roller conveyors is needed in front of the oven because the machines are close to the entrance. Core plates and cores are lifted from the machine to the conveyor by a hoist.

Cores are baked in two continuous ovens which will be described later. One of the principal features of the system is the use of special steel drying plates manufactured by the Wadsworth Core Machine & Equipment Co., Akron, O. These plates which may be seen in Fig. 27, are constructed of light steel, suitably reinforced on the under side with angles around the four sides, and with two angles placed diagonally across the corners. It is claimed they remain perfectly flat indefinitely.

Boiler cores in two pieces are made in the unit shown in Fig. 27. One piece is shown on the core plates visible in the illustration. The other is a flat section about 2 inches thick. The leg section is pasted to the flat section after they are taken from the oven. The core machine at the right of Fig. 27, makes the flat back for the cores. They are placed on the conveyor just in front of the machine, on one of the steel core plates. Four stout pins of the plate project vertically, one near each corner of the plate.

The leg section core on the conveyor shown at the left in the illustration is made on the machine in the center. The plates supporting these cores are placed over the flat cores, but are separated by the projecting pins. The two plates then are loaded on the oven trays. After the cores are baked they are removed to the conveyor shown at the left which carries them to the core pasting division. The upper core is picked up by an eccentric safety clamp and lowered on the flat core which has been well daubed with paste while still hot. The two cores are wired firmly together, inspected and forwarded to the storage or sent to the boiler foundry.

A better idea of the pasting operation may be gained from Fig. 31. This view shows cores also made in two parts for smaller boilers but placed side by side on the type of plate previously described. The workman standing in the left center with the clamp picks up the lower half of the core from the plate and places it on the conveyor at the right. Another man spreads a thick layer of paste on the joint face, and then the top half of the core is placed in position. The two sections wired together move on a conveyor to an inspector who gages and inspects them.

In the two large continuous ovens, 7 feet 8 inches wide, 19 feet high and 75 feet long, the trays containing the cores make 4 passes over the burners during their journey. These and the small ovens were designed by the staff of the Bond plant. Conveyor chain, structural work and various other parts were supplied by the Dodge Mfg. Co., Mishawaka, Ind.

A floating sprocket similar to that in the small oven is used in each of the larger ovens to maintain an even tension of the conveyor chain. The only difference is that the sprocket is placed in the upper part of the oven in the small oven, while in the large oven it is placed in a pit below the floor level. Also, the cores enter the large ovens from the front while they enter the small oven from the back. The two large ovens are fired by gas under higher pressure than that supplied by the city mains. One of the ovens is heated by a burner manufactured by the Surface Combustion Co., Toledo, O., and the other oven is heated

Fig. 31—After the Cores Leave the Ovens, They Are Pasted Together While Still Hot

by a burner made by the American Radiator Co., for its gas-fired heating units.

Since the boiler cores are much larger in section than the cores baked in the small oven, a longer period is needed to bake them. Therefore, the speed of the chain is reduced so that the cores take about 2 hours to pass through the oven. The baking temperature is maintained at about 500 degrees Fahr. by an electrical controlling device supplied by the Leeds & Northrup Co., Philadelphia. An automatic recorder with a 24-hour chart enables the oven operator to maintain a visual check on the oven temperature.

Another modern feature of the large ovens is the arrangement provided for recirculation of the core oven gases. Baking oil-sand cores creates an atmosphere heavily freighted with gaseous vapors. Ordinarily, these gases are carried by ventilating stacks to the outside atmosphere, but in these continuous ovens the gases are recirculated through the burners to supply heat. In this manner, the consumption of fuel is reduced to some extent.

Due to the heavy thickness of sand section at the top of the boiler cores, provision had to be made for uniform baking speed. This was accomplished by leaving two wedge-shaped openings in the upper part of the core. If the illustration shown in Fig. 27 is examined closely, these openings may be observed. The section of the core is approximately the same thickness through the walls. Wedge-shaped pieces of core sand to fit these openings are made in the same coreboxes, and placed on the plate with the core. They are pasted in place at the same time that the two halves of the core are pasted together as previously described.

One of the first requisites in making any casting is a good pattern. This principle is followed to the minutest detail in the Bond plant, where a completely equipped master wood pattern shop employing skilled patternmakers is operated. A view of this department is shown in Fig. 26. Although iron patterns are used throughout the various foundries, the first or master patterns are made in this shop. From the master wood pattern, a master iron pattern is made, and this is used for supplying the working patterns used in the foundry.

Due to the fact that two other patterns are made from the master wood pattern, allowance has to be made for the triple shrinkage involved. Hence every point on the master wood pattern has to be made with the strictest accuracy. Also in designing the pattern, careful consideration is given to the manner in which the working pattern should be gated to obtain the best results. A tremendous amount of work is involved in supplying patterns for a boiler of new design. Looking at an assembled boiler one hardly realizes the large number of parts required, or the volume of pattern making expense necessary to supply these separate patterns for each item.

Some mention previously has been made of the crating or box department. This department supplies all boxes and crates for shipping the almost innumerable parts that accompany each boiler. These include the nipples, the rods used for fasting the sections together, coal doors, ash-pit doors, cleanout doors, dampers, smoke hoods, with the hinges and bolts for fastening them to the boiler, etc. Last, but not least, a complete set of fire tools, excepting the shovel, accompanies each boiler to the place where it is installed.

All these items, of course, are not put in one box, but divided into several parts. Each boiler shipped in sections, is accompanied by a list of parts, and as each part is put into its proper box, it is checked from the list. In this way there is small chance for any part being overlooked. Fig. 30 shows the boxing department. Sawed boards from the wood shop are formed into boxes by automatic nailing machines, and set on the far end of the roller conveyor shown in the illustration. As each box passes a bin, one of the required parts is put in and checked from the list.

The box is filled before it arrives at the scale shown at the left where the cover is nailed on. A wire fastened around both ends gives additional protection against the box breaking open from rough handling. The prepared boxes are placed on skids and conveyed to the warehouse or to the cars.

Due to the great amount of transportation between the various departments of the Bond plant, a large fleet of different types of 2 and 3-ton trucks is maintained. These include electrically driven and gasoline driven trucks of the push, elevating platform and crane types. The company has 47 trucks supplied by several different firms in operation in the different departments. Fig. 32 shows an electrically driven storage battery type truck used for loading large boiler sections into railroad cars.

Fig. 32—Crane Type Electric Trucks Are Used to Load the Sections into Railroad Cars

Receives Appointment

J. Spotts McDowell has been appointed director of research of the Harbison-Walker Refractories Co., Pittsburgh. Mr. McDowell has been associated with the Harbison-Walker company for about 20 years. He was graduated from the Massachusetts Institute of Technology in mining engineering, and is a member of the American Ceramic society, American Society for Testing Materials, and the American Refractories institute.

The Shakeout

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PAT DWYER, Engineering Editor
EDWIN BREMER, Metallurgical Editor
FRANK G. STEINEBACH, Managing Editor
CHARLES VICKERS, Nonferrous Editor
NORMAN F. HINDLE, Assistant Editor

¶ Outlook Is Good

DURING 1928 the electrical industry continued a steady growth which has characterized it for the past 20 years, and prospects for 1929 are encouraging. Consumption of electric power increased about 10 per cent with a corresponding gain in the production of electrical apparatus according to statements from the large electrical companies. There is no indication of a reduction in the rate of general electrical progress and there is reason to believe that the demand for electrical apparatus for railroad electrification, ship equipment, and certain other applications will be increased materially.

STATEMENTS of this nature coming at the threshold of the new year promise well for the foundry industry, because a steady demand for electrical apparatus means a steady flow of castings for their construction and for the machinery they drive. Announcement of comprehensive plans for the electrification of the Pennsylvania railroad and definite plans for electric suburban service on the Reading and the Lackawanna railroads indicate demands for equipment in which castings will be essential parts. Successful results shown by the new oil-electric, and the gasoline-electric engines undoubtedly will mean employment of these types in larger numbers.

NEW types of electric railway cars adapted to modern conditions have been developed during the past year and it is expected that they will be purchased in considerable number by the street railways. Invasion of the rural area by the electrical industry is making rapid headway and within the next 10 years electric service should be available to a larger proportion of farms. This development will create a demand for electrically operated farm machinery and household appliances which will employ numerous castings. Another feature to be considered is that, as use of electric power continues of grow, more and larger generating plants will have to be built. This in turn will reflect on the foundry industry due to the employment of a variety of castings in the construction of the equipment.

¶ More Discussion Needed

WHILE the habits and customs of foundrymen the world over partake of the same general characteristics, due, of course, to the fact that the basic principles are alike wherever metals are melted and poured into castings, still the viewpoint and practice in several features differ to some extent. An interesting contrast and a contrast in which we do not shine to advantage, is found in the attitude of the members who attend the meetings of their local associations. On both sides of the Atlantic meetings convene to hear papers or addresses by men presumably well qualified to present views on one or more of the multitudinous phases of the casting industry. Up to the conclusion of the paper or the address, the behavior at both meetings is the same, but at that point the resemblance ceases. In a few instances the American foundry audience discusses the paper to a slight extent. In the majority of cases, the usual vote of thanks, tendered the speaker, is the signal for adjournment.

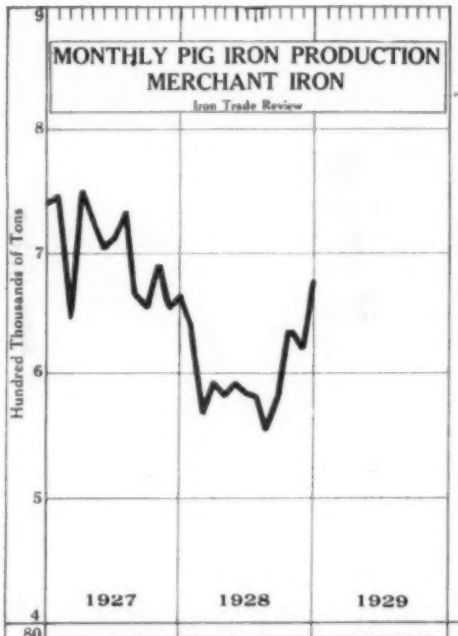
EUROPEAN foundrymen's associations conduct their meetings on the apparently logical assumption that the time to get information is while the getting is good. What more ideal setting could be provided than a friendly gathering of men experienced in many lines, a qualified speaker to introduce a more or less controversial topic and an hour or more of an open forum for the audience to express its opinion through the individuals. In this manner, each man present takes a lively interest in the proceedings. He brings something with him and takes something away. Another advantage of this method is that the secretary is not under a constant nervous strain to provide outside speakers. Practically every member of the local branch is qualified through training and experience to introduce and discuss a subject suitable for a foundrymen's meeting and in the majority of instances will accede to the secretary's request to prepare a paper or lead an oral discussion on some controversial point. Certainly controversial points never are lacking.

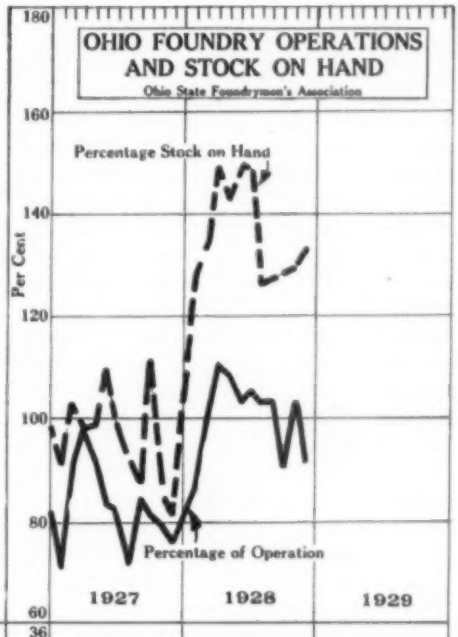
Trade Trends in Tabloid

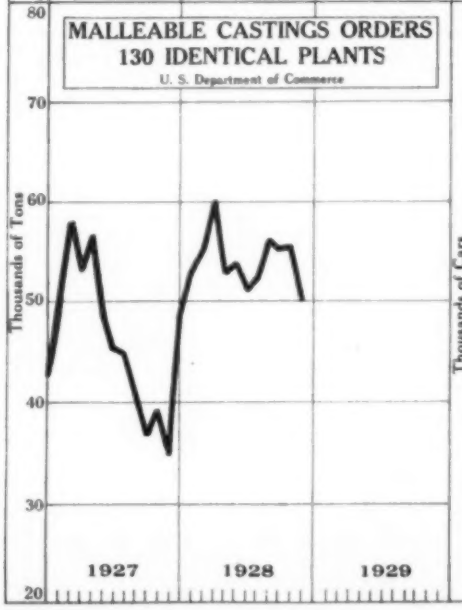
FOUNDRY operations continue at a high rate with only a slight diminution over the year's end. Automotive production, with estimated figures for December, is expected to show 1928 the peak year for all time, with a total of more than 4,600,000 cars. Stove and furnace demand is supporting full time operations in foundries making this class of work, while the radiator and sanitary ware shops are active. Steel foundry operations show signs of improvement. Railway buying anticipates heavier sales of steel castings. Agricultural implement sales have been unprecedented and expansions are under way in shops making farm machinery. Tractor manufacturers also are building additions. December pig iron production showed a slight decline according to statistics compiled by Iron Trade Review. The total is larger by reason of the longer month, an output of 3,376,267 tons being estimated for December against 3,304,656 tons for November. The daily average rate declined from 110,155 tons in November to 108,912 tons in December. Merchant iron totaled 632,869 tons in November and 686,431 tons in the last month of the year. Monthly nonferrous price averages for December, according to New York quotations in *Daily Metal Trade* follow: Casting copper, 15.771c; electrolytic copper, 16.070c; Straits tin, 50.302c; lead 6.49c; antimony, 9.765c; aluminum, 23.90c. Zinc averaged 6.349c, E. St. Louis, Ill.

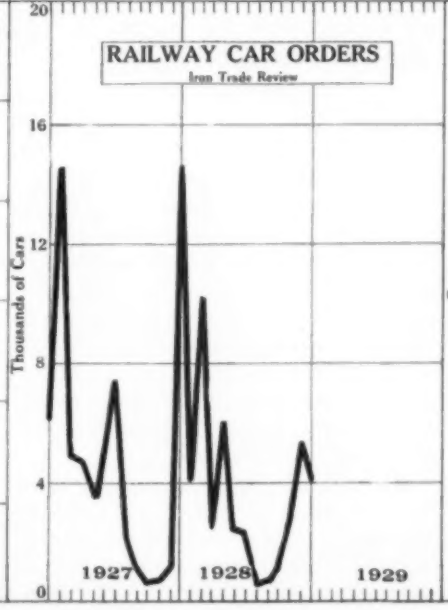
RAW MATERIAL PRICES
Jan. 8, 1929

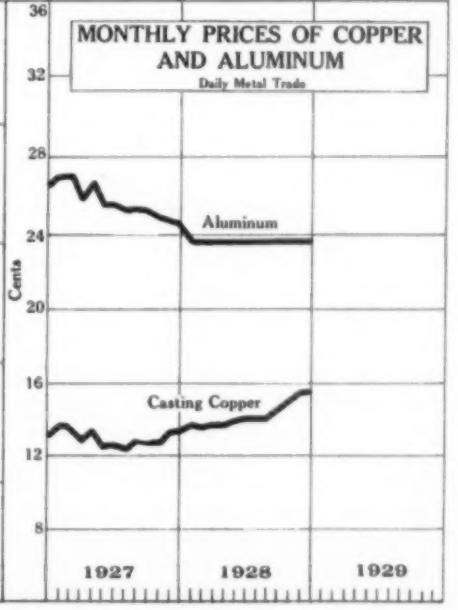
Iron	
No. 2 foundry, Valley	$18.00
No. 2 southern, Birmingham	16.50 to 17.00
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.26 to 21.76
No. 2 foundry, Buffalo	18.50
Basic, Valley	17.50 to 18.00
Basic, Buffalo	17.50
Malleable, Chicago	20.00
Malleable, Buffalo	19.00
Coke	
Connellsville foundry coke	$3.75 to 4.85
Wise county foundry coke	4.50 to 5.25
Scrap	
Heavy melting steel, Valley	$17.00 to 17.50
Heavy melting steel, Pitts	18.50 to 19.00
Heavy melting steel, Chicago	14.75 to 15.25
Stove plate, Buffalo	14.50
Stove plate, Chicago	12.25 to 12.75
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	15.75 to 16.25
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	15.00 to 15.25
No. 1 cast, Birmingham	14.50 to 15.00
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.00 to 14.50
Railroad malleable, Chicago	18.00 to 18.50
Agricultural mal., Chicago	13.50 to 14.00
Malleable, Buffalo	15.75 to 16.25
Railroad malleable, Pitts	15.00 to 15.50
Nonferrous Metals	
	Cents per pound
Casting, copper, refinery	16.50
Electro, copper, producers	16.75
Straits tin	50.00
Lead, New York	6.65
Antimony, New York	9.75
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.50 to 17.00
Zinc, East St. Louis, Ill	6.35











Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

CARL S. NEUMANN, recently nominated for the office of president of the New England Foundrymen's association, was graduated from the New Britain high school in 1896 and for the next three years worked for P. & F. Corbin, hardware manufacturers in that city. From 1898 to 1902 he attended Wesleyan university, Middletown, Conn., graduating with an A.B. degree. In 1903 he became connected with the Union Mfg. Co., having worked for that company for several years during the vacation periods. In 1906 he was elected assistant secretary, in 1907 a director and later secretary, the position which he now holds. He has been on the executive committee of the New England Foundrymen's association for several years and was vice president in 1928. He has been secretary and director of the Connecticut Foundrymen's association since its organization in 1919. Mr. Neumann is the third generation in his family to be engaged in the foundry business. Both of his grandfathers and his father were foundrymen. His father's father was connected with the old Pierson & Meeker Malleable Foundry on Clay street, Newark, N. J. His mother's father was foreman of the foundry of Sargent & Co., formerly of New Britain and now located in New Haven, succeeding a brother, who was general superintendent of that company for many years. Mr. Neumann's father served a full apprenticeship as a molder and metal patternmaker, was connected with the Union Mfg. Co. for several years and finally established a metal patternshop of his own.

I. J. Reynolds recently was appointed foundry superintendent by the Quaker Mfg. Co., Chicago Heights, Ill.

Sherwood Bennett, secretary-treasurer Capitol Casting Co., Lansing, Mich., was recently elected president of the Lansing Traffic club.

Arthur E. Blackwood, Chicago, recently was elected president of the Sullivan Machinery Co., 146 South Michigan avenue, Chicago, to succeed the late Fredrick K. Copeland. Mr. Blackwood has been with the Sullivan Machinery Co. for the past 32 years. After his graduation from Toronto university as a mechanical and electrical engineer, he became associated with the company and later became manager of the eastern sales department with headquarters at New York. He held this office for 23 years and then was elected a director and first vice president in charge of finances. He held this office until his recent election to the presidency.

CARL S. NEUMANN

Dr. Fritz W. Meyer, research metallurgist, American Radiator Co., New York, has resigned to become chief metallurgist, National Radiator Corp., Johnston, Pa.

Fred C. Sanborn recently was elected to the board of directors of the Belding Foundry Co., Belding Mich, to fill the vacancy caused by the death of R. Howard Hall.

F. I. Brown, president, Arkansas Foundry Co., Little Rock, Ark., recently was elected president of the Little Rock chamber of commerce.

James K. Dickey has been elected secretary of the Burnside Steel Foundry Co., 1300 East Ninety-second street, Chicago, to succeed Harry J. Finley who died recently. Mr. Dickey was graduated from Purdue university, Lafayette, Ind., in mechanical engineering in 1920 and has been in the steel foundry business continuously since that time.

A. A. Grubb, Ohio Brass Co., Mansfield, O., will present a paper at the Western Metal congress held Jan. 14-18 at the Shrine auditorium, Los Angeles. The subject of the paper is "Sand Testing Equipment and Demonstration." Mr. Grubb is attending the congress under the auspices of the American Foundrymen's association to present the problems of sand control to those who are interested and especially to the members of the American Foundrymen's association who have not been able to attend the meetings of the American Foundrymen's association in the east.

Robert L. Cooley, director of the Milwaukee Vocational school, was reelected president of the American Vocational association at its annual convention held recently in Philadelphia.

C. J. Butler, for years superintendent for the Sharon Foundry Co., Wheatland, Pa., has taken a position with the United Engineering & Foundry Co., at Pittsburgh in charge of the sale of miscellaneous steel castings.

Fred O. Smith, secretary and manager of purchases, Vulcan Iron Works, Wilkes-Barre, Pa., has been elected vice president of the company. He also is a director of the company and vice president and director of the Wilkes-Barre Iron Mfg. Co., Wilkes-Barre, Pa.

Holds Foundry Meeting

The University of Wisconsin, Madison, Wis., through its extension division and department of mining and metallurgy, will hold its third annual foundry conference at the university, Feb. 5-8, inclusive. These conferences have been organized for persons engaged in or interested in foundry practice and especially for managers, superintendents, foremen, metallurgists and chemists. The feature of this conference will be the session on apprenticeship under the direction of C. J. Freund, apprentice supervisor, Falk Corp., Chicago.

To Build Addition

The Independent Pneumatic Tool Co., 600 West Jackson boulevard, Chicago, will build an addition to its factory at Aurora, Ill. The new structure will consist of a modern, fireproof, concrete building and will add 36,000 square feet to the present capacity. Plans have been drawn and the work will commence soon.

Obituary

John Gandee Dean, president, Dean Bros. Co., Indianapolis, died Dec. 31 at an age of 83 years. Mr. Dean was born in Deansboro, N. Y., on Sept. 15, 1845 He received his education at Whitestown seminary, Whitestown, N. Y. In 1867, he and his brothers entered the foundry and machine business at Utica, N. Y. Two years later they moved their business to Indianapolis and established a plant at Madison avenue and Ray street. The plant later was moved to its present location at Tenth street and the canal. Although Mr. Dean had been ill for some time, he kept in touch with the operations at the plant and took an active interest in the company until his death.

G. A. Doeright, 58 years old, president of the Falcon Bronze Co., Youngstown, O., died Jan. 1 at his home in Youngstown. He had been ill for a week.

Frank H. Teagle, 49 years old vice president and treasurer of Bishop & Babcock Mfg. Co., Cleveland, died Dec. 29 at his home in Cleveland. He was a brother of Walter C. Teagle, president of the Standard Oil Co. of New Jersey.

Thomas F. Kent, vice president of the Magnus Co. Inc., New York, manufacturers of railroad supplies, died Dec. 25 at a New York hospital. Mr. Kent had been with the Magnus company for 30 years and was a native of Detroit.

Harry J. Finley, secretary, Burnside Steel Foundry, 1300 East Ninety-second street, Chicago, died Dec. 23, following a brief illness. Mr. Finley was 35 years old and had been in the service of the company for nine years in various capacities.

Charles F. Fuerst, superintendent, Crucible Steel Casting Co., Milwaukee, died Jan. 3 at the age of 42 years. He had been ill with heart disease for nearly two years. Mr. Fuerst was a native of Germany.

Martin Hawke, managing director, Carborundum Co., Ltd., Manchester, Eng. died Dec. 20, after a short illness. Mr. Hawke was born in Cornwall, Eng. and came to the United States when a young man to become identified with the Hudson-Chester Granite Co., Chester, Mass. In August, 1900, he became connected with the Carborundum Co., as continental represenative and traveled Europe establishing agency representations for the company. In 1912, the Carborundum Co. built a plant at Manchester, Eng., and Mr. Hawke was made managing director.

Otis P. Briggs, formerly president and commissioner, National Founders association, died at Minneapolis Jan. 1, following a brief illness. He was 72 years of age. Mr. Briggs was born at Livermore, Me., and attended school there. He went to Minneapolis when 21 years old and took a position with the Minnesota Iron Works. Later, he was employed by the Pray Mfg. Co. In 1886, he organized the

OTIS P. BRIGGS

Twin City Iron Works which continued in operation until 1902 when, with J. L. Record, George Gillette and Ralph Gillette, he established the Minneapolis Steel & Machinery Co. In 1902, Mr. Briggs left the firm to become commissioner of the National Founders association. He served in that capacity until 1905 when he was elected president of the association. Mr. Briggs was one of the first members of the Twin City Foundrymen's association. He also was active in the organization of the National Metal Trades association.

Arthur D. Nichols, manager, Birmingham, Ala., plant, American Radiator Co., died recently after a week's illness with pneumonia. Mr. Nichols took charge of the Birmingham plant two years ago, being transferred from the Buffalo works. He was a native of Springfield, Mo.

Henry Rathbone Micks, president, Rumsey Pump Co., Ltd., Seneca Falls, N. Y., died Dec. 25, at the city hospital after a short illness. Mr. Micks was born in Clinton, N. C., July 25, 1854. He was graduated from Union college, Schenectady, N. Y. in 1875. Mr. Micks formerly was secretary and general manager, La France Mfg. Co., Elmira, N. Y., and a member of the firm of Boykin Carmer & Co., Baltimore. In 1898, he moved to Seneca Falls, N. Y., to become president and general manager, Rumsey Pump Co., Ltd. He was actively in charge of the business at the time of his death.

Cornelius A. Bickett, aged 64, chairman of the board of directors of the Chicago Bearing Metal Co. and vice president and director of the Magnus Co. Inc., Chicago, died Dec. 25, at his winter home at Miami Beach, Fla. Mr. Bickett formerly was president of the Bickett Coal & Coke Co. and the Franklin Coal & Coke Co. until these two firms were purchased by the Franklin County Coal Co. Mr. Bickett was a native of Cincinnati.

George F. Hutchins, for many years superintendent, Crompton & Knowles Loom Works, Worcester, Mass., died Dec. 12 at the age of 87 years. Mr. Hutchins was known widely both as a mechanic and inventor in the development of weaving, particularly in connection with the fancy loom. He was born in Hepburn, Pa., but later moved to East Douglas, Mass., where he learned his trade in the works of the Douglas Axe Co.

Nominates Officers

The New England Foundrymen's association recently announced the following nominees for the various offices and the executive committee: President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; vice president, Ernest F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass.; treasurer, George H. Gibby, Gibby Foundry Co., East Boston, Mass.; secretary, Fred F. Stockwell, Barbour-Stockwell Co., Cambridge; executive committee, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; H. A. Lincoln, Sullivan Machinery Co., Claremont, N. H.; William W. Brierly, Millbury Steel Foundry Co., Millbury, Mass.; Warren D. Kent, Grinnell Co., Providence, R. I.; Charles A. Reed, Rogers, Brown & Crocker Bros Inc., Boston.

Wisconsin Group Meets

The regular monthly meeting of the Wisconsin Gray Iron group was held Jan. 9, at the Schroeder hotel, Fifth street and Wisconsin avenue, Milwaukee. The meeting featured a talk by David G. Anderson, chief of foundry development engineers, Western Electric Co., Chicago, who spoke on examples of improved foundry practices.

Hold Series of Meetings for Gray Iron Group

The Gray Iron institute, with headquarters at Cleveland, is holding a series of meetings in different parts of the country in co-operation with various district groups. Representatives of the institute are attending these meetings and are explaining the purposes and work of the organization. A dinner meeting was held at the Syracuse hotel, Syracuse, N. Y., Jan. 8 under the auspices of the Central New York Foundrymen's association. Gray Iron foundrymen in the Chicago district met at the Palmer House, Chicago, Friday noon, Jan. 11, and Wisconsin foundrymen held a dinner meeting at the Schroder hotel, Milwaukee, on Jan. 14.

Additional meetings are scheduled for the near future. On Jan. 16, the foundrymen of the St. Louis district will hold a dinner meeting at Claridge hotel, St. Louis under the auspices of the St. Louis Foundrymen's club. Arrangements are being made by the Central Illinois Foundrymen's association for a meeting at the St. Nicholas hotel, Decatur, Ill., on Jan. 19. Iowa foundrymen will hold a luncheon meeting at the Roosevelt hotel, Cedar Rapids, Iowa, on Jan. 21. Foundrymen in the Minneapolis-St. Paul district will hold a dinner meeting at the Minneapolis Athletic club on Jan. 22.

Casts Quality Work

(*Concluded from Page 61*)

cessive wintry blasts or drafts.

Steam for heating the plant is generated by oil burners which are regulated automatically. The heating elements placed overhead throughout the plant consist of a radiator and a fan. Air, heated by the radiator, is circulated throughout the building by the fans. The heaters were built by the Dwyer Equipment Co., Chicago. Practically no labor supervision is required for the boiler room where steam is generated and air compressed.

The foundry, furnace and shop buildings are fireproof with concrete steel and brick walls and gypsum roof. Beams all are of steel. The plant buildings were designed by Frank D. Chase, Inc. The acreage of the company at the present site is sufficient for more than doubling the capacity of the present plant.

To obtain ample lighting and a constant and well-controlled ventilation, the overhead and side lighting of the foundry building was given much attention. The foundry building proper has a frame and truss roof with continuous windows, manufactured by David Lupton's Sons Co., Philadelphia.

Analyses Conditions

(*Concluded from Page 68*)

salaried employes must be watched, particularly being positive that each is contributing in a constructive manner toward the most economical operation. Cost of distribution including sales and advertising must be carefully considered. The customer who already is sold looks askance at further sales efforts because he feels that the portion of his dollar that the supplier spends for this purpose is wasted so far as he is concerned.

Finally the careful and intelligent buyer under any condition of competition will get all he can for his money. In periods of competition like the present, it is the seller who determines what the buyer is to get for his money. In order to meet this competition it is necessary for the managers of each business to see that they are buying wisely, manufacturing efficiently, using economical methods and machinery, holding plant and inventory investment to a minimum, getting the most out of labor, selecting their supervisory people and paying them wisely, and looking to their distribution costs.

Index Is Ready

AN INDEX of Volume LVI of THE FOUNDRY, *covering the issues from Jan. 1 to Dec. 15, 1928, inclusive, now is ready for distribution. This index gives complete references and cross references of all material which has appeared in the 24 issues of the publication. It covers thoroughly approximately 275 special articles, the 200 regular features and the vast amount of miscellaneous interesting information on the various phases of the foundry industry which have appeared during the past year. Readers who bind or preserve the issues of* THE FOUNDRY *will find the index of considerable value in any research or reference work which may be undertaken. The index will be mailed free to any reader who requests it from* THE FOUNDRY, *circulation department, Penton Building, Cleveland.*

Approve Expenditure for Liquid Shrinkage

On Oct. 10, 1928, the committee on cast iron of the American Foundrymen's association held a meeting in Philadelphia. After reviewing the field of needed research they decided that there is a pressing need of methods of tests to correlate data on fluidity, liquid shrinkage and solid contraction. It was shown that the bureau of standards already had developed a test for solid contraction, and now is working out a test for fluidity. This left unexplored the test for liquid shrinkage, and the members of the committee recommended that the board of directors of the American Foundrymen's association make an appropriation of $3000 for this work.

Recently the board of directors approved the expenditure of this sum to investigate the development of tests for liquid shrinkage. Due to facilities and supervision available at the bureau of standards, the investigational work will be carried on through the research associate plan at the bureau. This means that the committee on cast iron will support one research associate at the bureau for a year who will investigate and develop a test for liquid shrinkage.

Changes Meeting Date

The council of the British Institute of Metals has found it necessary to alter the date of the twenty-first annual general meeting and *Coming-of-age* celebrations of the institute from that originally announced, March 6 and 7, to March 13 and 14.

A dinner and dance will be held on March 13. An interesting function is being arranged for the second day of the meeting. This is a round table discussion and exhibition to be held in the Science museum, South Kensington, London, on March 14. Objects of special interest in relation to the work of the institute will be displayed; offers of such objects are invited and should be made to the secretary, G. Shaw Scott, 36-38 Victoria street, Westminster, London, S. W. 1, England.

The annual autumn meeting will be held in Dusseldorf, Germany, in September. Offers of papers for that meeting are invited by the council, which, it is understood, will particularly welcome papers dealing with matters of practical interest. It is proposed also to hold a general discussion on laboratory methods of metallurgical research at Dusseldorf in which speakers from many countries are expected to participate.

Committee Nominates A.F.A. Officers

Fred Erb, president of the Erb-Joyce Foundry Co., Detroit, was nominated for the office of president of the American Foundrymen's association at a meeting of the nominating committee held recently in Cleveland. N. K. B. Patch, secretary of the Lumen Bearing Co., Buffalo, was nominated for vice president of the association. Nominations for the board of directors are as follows: S. T. Johnston, vice president of the S. Obermayer Co., and the National Engineering Co., Chicago; H. S. Falk, vice president and general manager of the Falk Corp., Milwaukee, F. J. Lanahan, vice president, Port Pitt Malleable Iron Co., McKees Rocks, Pa.; Arnold Lenz, manager, Chevrolet Motor Co., Gray Iron Foundry, Saginaw, Mich.; Delos H. Wray, vice president of Henry Wray & Son, Rochester, N. Y. As provided in the constitution, if no additional candidates are nominated by 25 or more members of the association, the nominees of the nominating committee are declared elected at the annual meeting.

The following members of the nominating committee were present at the Cleveland meeting: L. W. Olson, Ohio Brass Co., Mansfield, O.; A. B. Root Jr., Hunt-Spiller Mfg. Corp., Boston; S. W. Utley, Detroit Steel Casting Co., Detroit; C. D. Carey, American Steel Foundries, Veron, Pa.; Robert L. Poole, General Railway Signal Co., Rochester, N. Y.; H. S. Simpson, National Engineering Co., Chicago. and C. C. Smith, Toledo Steel Castings Co., Toledo, O.

To Build Large Plant

Rundle Mfg. Co., Twenty-sixth and Cleveland avenues, Milwaukee, has plans under way for the construction of a group of buildings near Camden, N. J., along the Delaware river. The estimated cost of this plant is $1,000,000. The improvements will consist of a foundry building 150 x 330 feet, with outside craneway, casting cleaning building 100 x 140 feet, enameling building 100 x 180 feet, and an adjoining 3-story building. A warehouse and shipping building 120 x 180 feet will be part of this group. All buildings will be connected by basements. A power house with substations, motor driven compressors and heating plant will be erected. It is expected that construction work will begin about Feb. 1. Electric bridge cranes, hoists, elevators, exhaust system, sandblast, cupolas, blowers and conveying machinery will be purchased. This company manufactures enameled iron ware, such as tubs, sinks, lavatories, etc. Officers of the company are Henry Held, president; L. A. Kinnear, vice president; and A. C. Held, secretary and general manager. A. A. Wickland & Co. Inc., 205 West Wacker drive, Chicago, are the engineers

N. E. Foundrymen Throw a Farewell Party

Leroy P. Robinson, for the past twelve years New England representative of the Werner G. Smith Co.,

LEROY P. ROBINSON

Cleveland, and the Sterling Wheelbarrow Co., Milwaukee, moved to Cleveland Jan. 2, to take up his new duties as director of core oil sales of the Werner G. Smith Co. In recognition of the prominent part he has played in both associations, the New England Foundrymen's association and the Associated Brass Founders of New England tendered Mr. Robinson a complimentary dinner Dec. 19 at the Engineer's club, Boston, as mentioned briefly in the Jan. 1 issue of THE FOUNDRY. Gifted with a ready wit and a genial disposition the guest of honor ably upheld a reputation for good fellowship that has characterized all his activities at the regular meetings and outings of the foundrymen's association over a period of many years. About a year ago he played a prominent part in organizing the Associated Brass Founders of New England and has served as secretary of this association from its inception. A traveling bag was presented by Henry Blumenauer, president, Arcade Malleable Iron Co., Worcester, Mass., on behalf of the association. Felicitation at his promotion and regret at his departure were expressed by J. A. Duncan, president, Wm. Duncan Co., East Boston; Charles Miller, president, New England Foundrymen's association; Charles Reed, prominent member of the same association, and A. B. Root, past president of the New England Foundrymen's association and of the American Foundrymen's association.

Crane Makers Merge

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., and the Niles Crane Corp., formerly a division of the Niles-Bement-Pond Co., 111 Broadway, New York, have been merged under the name of the Shepard-Niles Crane & Hoist Corp. The new company will manufacture both large and small cranes and hoists. The Shepard plant at Montour Falls, N. Y., will produce the smaller cranes and hoists and the Niles plant at Philadelphia, will make the larger equipment. The company will operate as three divisions, the Shepard, Niles, and Sprague divisions. The latter has been identified with the former Shepard Electric Crane & Hoist Co., for a considerable time. The main offices will be at Montour Falls, N. Y. The officers of the new corporation are: A. E. Doods, head of the Niles-Bement-Pond Co., chairman of the board of directors; S. G. H. Turner, formerly president of the Shepard company, chairman of the executive committee; Frank A. Hatch, formerly vice president and general manager of the Shepard company, president; Sidney Buckley, formerly president of the Niles Crane Corp., first vice president; James A. Shepard, vice president and Robert T. Turner, vice president. In addition to these officers the directors will include Leonard S. Horner, president and Charles K. Seymour, vice president of the Niles-Bement-Pond Co.

Talks To Foundrymen

W. S. Quigley, president, Quigley Furnace Specialties Co., New York, addressed the Philadelphia Foundrymen's association at the regular monthly meeting held at the Manufacturers club, Philadelphia, Jan. 9.

Goehringer Foundry Supply Co., Inc., 919-921 West Fifth street, Cincinnati, has been organized. Edward L. Goehringer is president and William F. Hunsche is treasurer.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Sparta Foundry Co., Sparta, Mich., is planning to double its capitalization.

Standard Foundry Co., Southgate place, Worcester, Mass., soon will start work on a two-story addition, 35 x 41 feet.

Crane Co., Bridgeport, Conn., has started work on a plant, 120 x 600 feet, and a three-story cupola and elevator shaft, 32 x 45 feet.

Tamaqua Mfg. Works, Tamaqua, Pa., reports business good and that many big orders are on file.

New Orleans now produces nearly $2,500,000 worth of castings annually, according to a recent report.

New Process Casting Co., 46 Franklin building, Baltimore, Leo. H. Homand, president, contemplates erecting a plant. (Noted Dec. 1.)

Titusville Iron Works, Titusville, Pa., J. T. Dillon Sr., manager, contemplates the erection of foundry buildings.

Lakey Foundry & Machine Co., Muskegon, Mich., plans an expansion program, involving an expenditure of $200,000.

The Windsor Foundry Corp., Windsor, Vt., has started work on an addition to its gray iron foundry.

Union Metal Mfg. Co., Canton, O., has acquired the King Co., Sheffield, Ala., manufacturer of street lighting standards.

DeSoto Foundry & Machine Co., Mansfield, La., has completed its expansion program. (Noted Dec. 1.)

R. W. G. Foundry Co., Anderson, Ind., reports business good and that it gradually is increasing its production 50 per cent.

Hardwick Stove Co., Cleveland, Tenn., has approved plans for the construction of a 4-story manufacturing plant to cost about $100,000 with equipment.

Nash Motor Co., Kenosha, Wis., has broken ground for a new $400,000 foundry to be devoted exclusively to the manufacture of cylinder blocks.

Alamo Iron Works, Montana and Fayette streets, San Antonio, Tex., will erect a $12,000 addition to its pipe shop. The addition will be 60 x 96 feet. (Noted Jan. 1.)

Hamilton Beach Mfg. Co., Racine, Wis., E. O. Goss, president, plans the construction of a foundry. A. L. Flegel, 208 Baker block, is architect.

Central Foundry Co., Vincennes, Ind., has started plans for rebuilding a structure damaged in a recent fire. The building housed much plant equipment.

Monroe Brass & Aluminum Foundry, 616 West Monroe street, Chicago, recently started production. This company specializes in the production of automobile heaters.

Schneider-Bowman Co. Inc., Van Dyke street, Philadelphia, plans to rebuild that part of the foundry and pattern shop that was destroyed by fire Dec. 11, with a loss of over $70,000.

Brinton Foundry Co., Paul and Van Dyke streets, Philadelphia, has let the contract for a one-story addition to cost about $20,000 with equipment to Davidson & Lavery, 4438 Leiper street.

Ebinger Sanitary Mfg. Co., 184 Lucas street, Columbus, O., has awarded the general contract to E. Elford & Son, 555 Park street, South, for a one-story addition to cost about $40,000 with equipment.

Oklahoma Steel Castings Co., 1200 North Lewis street, Tulsa, Okla., has let a general contract to J. R. Former Co., Ritz building, for the construction of a one-story foundry unit.

Commonwealth Steel Co., Granite City, Ill., has concluded arrangements with Bradford & Kendall, Sydney, N. S. W., Australia, to manufacture the company's steel products in Australia.

Merger negotiations between the American Radiator Co., New York, and the Standard Sanitary Mfg. Co., Pittsburgh, have been completed. Negotiations had been under way for some time.

Sterling Brass Co., 9600 St. Catherine avenue, Cleveland, has awarded the general contract for the construction of a 3-story manufacturing plant to Julius Miller, 10819 Drexel avenue.

Kinney Iron Works, Twenty-eighth and Santa Fe avenue, Los Angeles, recently has completed an expansion program which almost doubled the size of the plant. The installation includes a new core room and equipment.

Harrison Radiator Corp., Walnut street, Lockport, N. Y., has awarded a general contract to John W. Cowper & Co., M. & T. building, for a three-story addition to cost about $130,000. J. R. Tyler, Rochester building, Rochester, N. Y., is the architect.

Acme Pattern & Model Works, Chicago Heights, Ill., recently has started business. This company will manufacture wood and metal patterns. H. A. Van Heusden is president of the company and A. H. Olson is secretary and treasurer.

Negotiations among Llewellyn Iron Works, Baker Iron Works and Union Iron Works, all of Los Angeles, for consolidation are expected to be completed soon. The transaction will involve around $6,000,000. It is understood that the new company will be known as the Consolidated Steel Corp.

The Ford Motor Co. has ordered a 20-ton electric furnace from the American Bridge Co., Ambridge, Pa., for installation in its Fordson, Mich., plant. The unit will be used for superheating gray iron and will be the third of a battery of seven of these units to be installed eventually.

W. D. Kennedy, Dallas, Tex., operating the Kennedy Machine & Brass Co., 2236 Live Oak street, and other local industries, have acquired a two acre tract of land at 3110 Oak Lane avenue, with a one-story building, 100 x 300 feet, for a group of factories. Kennedy Machine & Brass Co. will erect a new unit at this location at an early date. The project will cost more than $200,000.

Polachek Bronze & Iron Corp., and the Renaissance Bronze & Iron Corp., both of Long Island City, N. Y., have been organized by John Polachek and other officials of the Polachek Bronze & Iron Co., and Renaissance Bronze & Iron Co., Long Island City, N. Y., to take over and expand the later named companies. Erwin R. Geiger will be an official of both companies.

American Steel Foundries, Baldwin Locomotive Works and another company, at present unnamed, will have an interest in a new $10,000,000 steel foundry development at Eddystone, Pa. The plant will be located in a 150-acre site adjoining the Baldwin Locomotive Works and work will begin immediately. According to R. P. Lamont, president, American Steel Foundries, a new company will be organized to own and operate the plant.

New Trade Publications

TRADE CUSTOMS—Nugent Steel Castings Co., Chicago, has used its current bulletin for the purpose of stating the standard trade customs of the steel foundry industry as adopted by the Steel Founders' Society of America.

MONORAIL SYSTEMS—Reading Chain & Block Corp., Reading, Pa., has issued a catalog of its monorail conveying systems. Details of its construction are shown, and leading features are illustrated. Engineering data cover design, strength and other details.

FLEXIBLE SHAFT MACHINES—The Stow Mfg. Co. Inc., Binghamton, N. Y., has published a catalog of the various flexible shaft tools which it manufactures. Each tool is illustrated and described. The advantages are listed, attachments described and prices quoted.

AIR FILTERS—Midwest Air Filters Inc., Bradford, Pa., has issued a folder giving the advantages, development, working principles and specifications of its new horizontal air filter. Charts and drawings show the construction and theory on which they are made. A table gives the specifications for filters of various capacities.

SPEED REDUCERS—Farrell-Birmingham Co. Inc., Buffalo, has published a catalog of its roller bearing type of speed reducers. It is fully illustrated, showing types of double helical gears, process of their manufacture and completed speed reducers. Drawings and tables of mechanical data supplement the text. Views of installations in various branches of industry are shown.

COMPRESSORS—Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has issued a catalog of its straight-line, steam and power-driven, air and gas compressors. The details of construction are described and illustrated fully. Sectional views of several of the machines, typical installations, and complete views of many of the compressors are included. Tables give the size of the machines and the last page is devoted to tables and illustrations of air receivers.

AUTOMATIC TEMPERATURE CONTROL—Leeds & Northrup Co., 4901 Stenton avenue, Philadelphia, has issued an 8-page booklet on the automatic temperature control of acid baths. The folder gives the principles upon which control is based and gives a layout of an illustration and explains it in detail. The care of the equipment also is discussed. Two pictures show a typical illustration. A price list of the various parts of an installation for automatic control of acid baths is appended.

DESULPHURIZING COMPOUNDS—The Mathieson Alkali Works, Inc., 250 Park avenue, New York, has issued its bulletin entitled "Refining Iron With Purite." The booklet tells the advantages of the use of this compound and the quantities to be used to give maximum efficiency. The equipment necessary for obtaining the greatest advantages by the use of this substance, such as self-slagging spouts, forehearths and various types of ladles, is discussed. Photographs of typical installations and sketches of the types of equipment discussed are distributed throughout the booklet.